

**EPA Superfund
Record of Decision:**

**NYANZA CHEMICAL WASTE DUMP
EPA ID: MAD990685422
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ASHLAND, MA
03/30/1993**

Text:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Nyanza Chemical Waste Dump Superfund Site
Operable Unit III
Ashland, Massachusetts

Statement of Purpose

This Decision Document presents the selected remedial action for this Site developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Contingency Plan (NCP), 40 CFR Part 300.

The Commonwealth of Massachusetts has concurred with the selected remedy.

Statement of Basis

This decision is based on the Administrative Record which was developed in accordance with Section 113(k) of CERCLA and which is available for public review at the information repositories located at the public libraries in the Ashland, Framingham, Wayland, Sudbury, Lincoln and Concord, Massachusetts, and at the EPA offices at 90 Canal Street in Boston, Massachusetts. The attached index identifies the items which comprise the Administrative Record upon which the selection of a remedial action is based.

Description of the Selected Remedy

The third operable unit is an additional source control remedy involving the cleanup of mercury-contaminated sediments in a wetland and certain drainageways between the area of former Nyanza, Inc. operations and the Sudbury River. These areas are referred to as the Continuing Source Areas. In summary, the remedy provides for: 1) excavation of sediment with mercury levels above 1 mg/kg from the Continuing Source Areas; 2) dewatering of the contaminated sediment; 3) disposal of dewatered sediments under a portion of the cap constructed under the first operable unit remedy; 4) reconstruction of the area of cap removed during disposal; 5) treatment, if necessary, of water from the dewatering operation with discharge to an on-Site surface water body; 6) restoration of impacted wetland areas; 7) institutional controls to limit exposure to contaminants in the Sudbury River; 8) planning and implementation of public awareness activities to increase public knowledge about contamination remaining in the Sudbury River sediments and fish; 9) performing certain pre-design studies to aid in the design of the selected remedy; and 10) creation of a fourth operable unit to conduct additional investigation of the Sudbury River.

The first operable unit ROD, which was signed in September 1985, addressed contaminated sludges and soils at the Site by excavating them from outlying areas, consolidating them with sludges already on Megunko Hill, and burying them under an impermeable cap. This remedy also included an upgradient diversion trench to preclude contact with groundwater and surface water

runoff with the buried material. Construction of the first operable unit remedy has been completed.

The second operable unit addressed groundwater contamination at the Site. This ROD, signed in September 1991, selected an interim remedial action that included extraction and treatment of groundwater for a minimum of five years and performance of additional studies before adoption of a final groundwater remedy. This interim remedy is currently being designed.

The third operable unit (OU III) remedy will address risks to human and ecological receptors currently posed by the Continuing Source Areas as well as eliminate these areas as sources of continued contamination to the Sudbury River. The cleanup level of 1 mg/kg of mercury in sediment was selected because it will be protective of aquatic organisms in the Continuing Source Areas and because this level is equivalent to background levels found in the River upstream of the Site. Furthermore, this cleanup level will be protective of human health in the Continuing Source Areas under all exposure scenarios. Because OU III does not include active remediation of contaminants in the Sudbury River, risks to human health and the environment will be controlled through the implementation of institutional controls and public awareness activities as an interim remedy until a final River remedy is selected under operable unit IV.

Declaration

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable for this remedial action and is cost-effective. The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. However, because treatment of the principal threats of the Site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. Given the relatively low levels of mercury detected in the Continuing Source Areas as compared to levels already beneath the cap, the fact that a cap was selected as the appropriate remedy for mercury-contaminated soils, sediments, and sludges under the first operable unit, and the fact that there is currently no destructive technology for metals, EPA has determined that containment of the contaminated sediments in the Continuing Source Areas is preferable to treatment.

REGION I

RECORD OF DECISION

NYANZA CHEMICAL WASTE DUMP SUPERFUND SITE

March 30, 1993

NYANZA CHEMICAL WASTE DUMP SUPERFUND SITE

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I. SITE NAME, LOCATION AND DESCRIPTION

The Nyanza Chemical Waste Dump Superfund Site is located in the Town of Ashland, Middlesex County, Massachusetts (see Figure 1). Ashland is located in the Metrowest area of eastern Massachusetts, bordered by Sherborn to the east, Southborough to the west and northwest, Framingham to the north, and Hopkinton and Holliston to the south. Ashland is 25 miles west-southwest of Boston, and 20 miles east-southeast of Worcester.

The term "Site" includes the former Nyanza, Inc. Property (as described below); drainageways between the Property and the Sudbury River; and the Sudbury River downstream to its confluence with the Assabet River in Concord (see Figure 2).[1] <Footnote>1 For purposes of implementing this remedy under CERCLA Section 121(e)(1), the "Site" shall be "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action." National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Section 300.400(e).</footnote> Some of these drainageways, referred to as the Continuing Source Areas are the focus of this Record of Decision (ROD). The Continuing Source Areas include the Eastern Wetland, Trolley Brook, Outfall Creek and the lower Raceway (see Figure 3). The Nyanza, Inc. Property (Property) includes the 35-acre area consisting largely of the area formerly owned and operated by Nyanza, Inc. The Property includes several wetlands, the Megunko Hill area, and the lower industrial area along Megunko Road. The Hill is located in the southern part of the Property and was formerly used as a landfill/disposal area. The lower industrial area was formerly the location of dye manufacturing facilities, the wastewater treatment system and a series of settling lagoons south of Megunko Road. The Property is approximately bounded by an active Conrail railroad line and Chemical Brook to the north, wetland areas and Cherry Street to the east, and undeveloped mixed hardwood forest land to the south, southeast, and west. The Sudbury River is approximately 700 feet north of the Property.

The Town of Ashland occupies approximately 12.9 square miles, of which 18 percent is open water and wetland areas, and more than 40 percent is intensively developed. The bulk of development has occurred in response to the need for single- and multiple-family housing created by rapid economic expansion along the major transportation routes: State Route 128 (I-95), I-

495, U.S. Route 9, and I-290. From 1951 to 1980, agriculture and open-land use in the area has decreased from 19 to less than five percent.

A description of the Site can be found in Section 3 of the Remedial Investigation Report.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Land Use and Response History

From 1917 through 1978, the Property was occupied by several companies involved in the manufacture of various products. Textile dyes and dye intermediates were produced at the Property until 1978 when Nyanza, Inc. apparently ceased operations. Products manufactured on the Property in addition to those previously mentioned included inorganic colloidal solids and acrylic polymers. Nyanza, Inc. was the most recent dye manufacturing company to occupy the Property. The former plant grounds now are occupied by several industrial concerns, the largest of which is Nyacol Products, Inc.

Starting in 1917, several types of chemical wastes were disposed of in various locations on the Property with the majority of these wastes deposited on Megunko Hill, which was used as an unsecured landfill. Wastes included partially-treated process wastewater; chemical sludge from the wastewater treatment process; solid process wastes (e.g., chemical precipitate and filter cakes) in drums; solvent recovery distillation residue in drums; and off-specification products. Process chemicals that could not be recycled or reused (including phenol, nitrobenzene, and mercuric sulfate) were also disposed of on the Property.

Chemical wastes were also disposed of in the wetland areas. The Trolley Brook Wetland received waste effluent discharge from various manufacturing operations in the area. The northwest wetland area at the headwaters of Chemical Brook contained wastewater treatment sludge and possibly received overflow from an underground concrete wastewater vault that discharged into Chemical Brook.

Nyanza, Inc. and its predecessors originally discharged the dye waste stream to a concrete "vault" or settling basin adjacent to the main process building. The vault was used as a central sump for the collection of wastewater from the entire Nyanza, Inc. operation, as well as for other generating tenants housed in the immediate vicinity. This vault was approximately 40 x 80 feet and approximately 10 feet deep. The liquid occasionally overflowed via a pipe into Chemical Brook which flowed into Trolley Brook and through Chemical Brook culvert into Outfall Creek and then into the Raceway that entered the wetlands along the Sudbury River. The vault was taken out of service in the 1960's or 1970's and was subsequently filled with sludge and covered over with fill. However, the vault continued to be a source of groundwater pollution at the Site until its removal in 1988. As part of an ongoing effort to ease river pollution, the Massachusetts Division of Water Pollution Control (DWPC) ordered Nyanza, Inc. to install a pretreatment system for industrial process water and to discharge the treated waste to the Metropolitan District Commission (MDC) sewer collection system. Nyanza, Inc. connected to the MDC system in March 1970.

The first type of contamination linked to the Site was mercury, discovered in the Sudbury River in 1970, as part of an overall investigation of mercury problems in Massachusetts for the DWPC. A follow up study in 1972 focusing on Nyanza, Inc. revealed mercury contamination in the Sudbury River was caused by uncontrolled sludge and wastewater disposal at the Property.

Since 1972, several investigations have been prompted by contamination present at or originating from the Property. From 1972 through 1977, DWPC and the Department of Public Health (DPH) cited Nyanza, Inc. for several contamination problems associated with dumping activities. Following a 1973 DWPC order to implement a plan to stop further groundwater pollution, Camp Dresser and McKee, Inc. (CDM), working for Nyanza, Inc., performed a 1974 investigation aimed at source identification and devised plans to control groundwater contamination from the Property; however, the plans were not implemented. In 1979, Edward J. Camille, an owner of several parcels of the Property, hired Connorstone Engineering, Inc. to complete the CDM groundwater pollution control program. However, the Massachusetts Department of Environmental Quality Engineering (DEQE, successor to DWPC, now known as the Department of Environmental Protection or DEP) halted these plans, pending further investigation. In 1980, DEQE released a Preliminary Site Assessment Report summarizing the Site history and findings of previous investigations at the Site (DEQE, 1980). MCL Development Corporation acquired much of the Property in 1981, and hired Connorstone Engineering, Inc. and Carr Research Laboratory, Inc. to characterize soil composition and locate sludge deposits.

The Nyanza Chemical Waste Dump Superfund Site was included on the original National Priority List (NPL) of Superfund Sites in 1982 and a preliminary Remedial Action Master Plan (RAMP) was prepared. In 1984, the Environmental Protection Agency (EPA) authorized NUS Corporation (NUS) to perform a Remedial Investigation/Feasibility Study (RI/FS).

The September 4, 1985 ROD divided the Agency's remedial response into Operable Units (OUs) for the purpose of addressing distinct problems. The September 1985 ROD was designated Operable Unit I (OU I) and selected soil and wetland excavation at nine localized areas of contamination; solidification of water bearing excavated sludge, sediments, and soil; and placement, capping and consolidation of those materials with material left in place on the "Hill" area in the southern part of the Property. A diversion trench has been constructed on the side of Megunko Hill above and around the capped area to divert surface water flow and lower the groundwater table beneath the cap as part of OU I. Construction of the project began in early 1989 and was completed in 1992.

In 1985, the DEQE undertook an Interim Response Measure at the Site consisting of the following activities: fencing the Trolley Brook Road embankment; placing one foot of clean fill in one of the Site areas to remove the threat of direct contact; and culverting Chemical Brook through neighboring property.

In January 1987, DEQE and the EPA Environmental Services Division (ESD) initiated a sludge removal action of the contents within the vault (see Figure 3). Prior DEQE studies indicated that the vault, and contaminated soil and groundwater in the vicinity of the vault, were a significant source of organic contamination in the groundwater downgradient of the area. Contaminants present included, but were not limited to, trichloroethene (TCE), chlorobenzene, and nitrobenzene, all by-products of aniline dye production. Inorganic contaminants found in the sludge included heavy metals such as antimony, cadmium and chromium. Initially, the vault contamination investigation was planned within the scope of Operable Unit II (OU II). DEQE and the EPA conducted a subsurface investigation in the vault and surrounding area, culminating in a decision to proceed immediately with remediation of the vault area. The removal action was conducted by EPA's Emergency Response Team. From October to December 1987, 665 tons of soil adjacent to the vault were removed; 309 tons were incinerated, and 356 tons were shipped off-Site to an approved landfill. In March and June 1988, 2,512 tons of sludge from the vault was solidified on-Site and disposed of

at an off-Site Resource Conservation and Recovery Act (RCRA) landfill facility.

In June 1987, EPA authorized the initiation of RI/FS activities for OU II, addressing contaminated groundwater migrating from the Property. A ROD was signed for this OU on September 23, 1991. The selected remedy was an interim remedy for groundwater cleanup that included extraction and treatment of groundwater for a minimum of five years and additional studies before adoption of a final remedy. This remedy is currently being designed.

A third phase of RI/FS investigations, OU III, focused on contamination in the drainageways between the Property and the Sudbury River and in a 33-mile stretch of the River. During the RI/FS, the scope of OU III was narrowed to focus on the Continuing Source Areas. The scope of this OU is discussed in Section IV, below.

A more detailed description of the Site history can be found in Section 1.2 of the Remedial Investigation Report.

B. Enforcement History

On April 4, 1982, EPA sent 10 general notice letters to 18 entities it believed were responsible parties. On January 22, 1991, based on newly acquired information, EPA notified approximately 21 parties of their potential liability with respect to the Site, some of whom had been previously notified in the 1982 letters. An additional party was notified on June 21, 1991 based on new information supplied by the existing PRPs. On July 22, 1991, eleven parties were removed from the PRP list. On December 28, 1992, EPA notified one additional party of potential liability based on new information. EPA, therefore considers eighteen parties potentially liable to perform or pay for the cleanup of the Site. EPA generally conducts negotiations with potentially responsible parties (PRPs) as soon as possible regarding the settlement of their liability at the Site. Some of the PRPs have formed a Steering Committee and substantial discussions between EPA and the Steering Committee have taken place.

The PRPs have been active in the remedy selection process for this OU. Technical comments presented by PRPs during the public comment period are summarized in the responsiveness summary, and the summary and written comments have been included in the Administrative Record.

III. COMMUNITY PARTICIPATION

Throughout the Site's history, community concern and involvement has been high. EPA has kept the community and other interested parties apprised of the Site activities through informational meetings, fact sheets, press releases and public meetings.

During 1986, EPA released a Community Relations Plan which outlined a program to address community concerns and keep citizens informed about and involved in activities during the planning and execution of remedial activities.

Upon the start of construction of the cap and diversion trench onSite in 1989, EPA intensified its community relations efforts in response to public concerns about safety issues related to the cleanup. For a several month period, weekly meetings were held with representatives of the police and fire departments, as well as with concerned citizens and representatives of organized labor.

In June, 1992 EPA held three informational meetings in the City of

Framingham, MA and the Towns of Sudbury and Concord, MA to discuss the results of the OU III Remedial Investigation. EPA distributed fact sheets at these meetings summarizing the results of the investigation.

On December 31, 1992, EPA made the administrative record for OU III available for public review at EPA's offices in Boston and at the Ashland, Framingham, Wayland, Concord, Lincoln and Sudbury Public Libraries. EPA published a notice and brief analysis of the OU III Proposed Plan in the Middlesex News on December 29, 1992 and made the plan available to the public at the above locations.

On January 6, 1993, EPA held an informational meeting to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Feasibility Study and to present the Agency's Proposed Plan for OU III. Also during this meeting, the Agency answered questions from the public. From January 7, 1993 to March 10, 1993, the Agency held a 62 day public comment period to accept public comment on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public. On January 27, 1993, the Agency held a Public Hearing to discuss the Proposed Plan and to accept any oral comments. A transcript of this hearing and the comments and the Agency's response to comments are included in the attached responsiveness summary, Appendix A.

IV. SCOPE AND ROLE OF OPERABLE UNIT

The OU I ROD was signed on September 4, 1985. This source control remedy called for the excavation of sludges and their consolidation under an impermeable cap constructed on Megunko Hill. The construction of this remedy is now complete.

The OU II ROD was signed on September 23, 1991. The remedy selected in this ROD was an interim remedy for groundwater cleanup that included extraction and treatment of groundwater for a minimum of five years and additional studies before adoption of a final remedy. This remedy is currently being designed.

Operable Unit III (OU III) was initially intended to address contamination of drainageways between the Property and the Sudbury River as well as a 33-mile stretch of the River. The selected OU III remedy addresses contamination in several of these drainageways, referred to as the Continuing Source Areas, and provides for additional investigations to be conducted in the Sudbury River. Alternatives addressing contamination in the River were eliminated from consideration under OU III because of an inability to evaluate their effectiveness using current data, the potential for adverse impacts, and the inordinately high costs associated with these alternatives. Additional investigation of the River is necessary to make a final remedy decision. However, because of the levels of mercury in the Continuing Source Areas which currently pose human health and ecological risks and the potential for these areas to continue to contaminate the Sudbury River, it is appropriate to address these areas now while additional information is being collected to assess the final remediation of the River, which has been designated as the fourth operable unit (OU IV).

In summary, the OU III remedy provides for: 1) excavation of sediment with mercury levels above 1 mg/kg from the Continuing Source Areas; 2) dewatering of the contaminated sediment; 3) disposal of dewatered sediments under a portion of the cap constructed under OU I; 4) reconstruction of the area of cap removed during disposal; 5) treatment, if necessary, of water from the dewatering operation with discharge to an on-Site surface water body; 6) restoration of impacted wetland areas; 7) institutional controls to limit exposure to contaminants in the Sudbury River; 8) planning and

implementation of public awareness activities to increase public knowledge about the River contamination; 9) performing certain pre-design studies to aid in the design of the selected remedy; and 10) creation of OU IV to conduct additional investigation of the Sudbury River.

V. SUMMARY OF SITE CHARACTERISTICS

A. General

Chapter 2 of the OU III FS contains an overview of the RI. The significant findings of the RI are summarized below. The RI report utilized information developed by previous studies and information developed as part of a two-phases field program to evaluate the OU III Sudbury River Study Area (Study Area). The Study Area includes the drainageways between the Property and the Sudbury River, including the Continuing Source Areas, and a 33-mile stretch of the River from Cedar Swamp in Westborough to the confluence of the Sudbury and Assabet Rivers in Concord. The specific objectives of the OU III field investigation activities are summarized below:

- to assess the nature and distribution of contaminants in surface water, sediments and biota of the Sudbury River and the drainageways between the Property and the River, including the Continuing Source Areas;
- to assess the public health and environmental risk associated with elevated levels of contaminants observed in the sediments, surface water and biota of the Sudbury River and the drainageways between the Property and the River, including the Continuing Source Areas;
- to develop response objectives; and
- to support the evaluation of remedial alternatives.

To achieve the above objectives, the two-phased field program commenced in September, 1989 and continued until July, 1991. The following field activities were conducted as part of these investigative efforts:

- sampling and analysis of sediments from Cedar Swamp Pond in Westborough to the beginning of the Concord River in Concord;
- sampling and analysis of surface water from Cedar Swamp Pond to Heard Pond in Wayland;
- sampling and analysis of fish from Cedar Swamp Pond to Fairhaven Bay in Concord;
- sampling and analysis of surface water and sediment in the Eastern Wetland, Trolley Brook, Chemical Brook culvert, Outfall Creek, and the Raceway;
- assessing wetlands adjacent to the River;
- sampling and analysis of sediment from locations within the bordering wetlands of the River;
- monthly water sampling from several locations to define seasonal fluctuations in water chemistry;
- surveying benthic biota (population density count) in the Study Area;
- sampling and analysis of caddis fly larvae in the River;
- surveying bathymetry and sediment thickness in Reservoirs 1 and 2; and
- inspecting the Chemical Brook culvert by remote video camera.

The results of these investigations are presented in detail in the RI report.

B. Physiography

A description of characteristics of the Sudbury River can be found in Section 3 of the RI Report. The drainageways investigated as part of OU III investigations included the following:

-The Eastern Wetland, which receives drainage from the eastern portion of the Property and constitutes the headwaters of a small tributary of the River.

-Chemical and Trolley Brooks, which are the primary surficial drainage

routes from the Property and the Eastern Wetland. The brooks merge and discharge through a subsurface culvert (Chemical Brook culvert) which discharges to a small creek called Outfall Creek and then to the lower Raceway, downstream of the Concord Street overpass in Ashland. Chemical Brook and the Trolley Brook Wetland were remediated as part of OU I.

-The Raceway, a man-made canal which channelizes a portion of the river flow from a flow-control gate at Mill Pond into a culvert which passes beneath a large mill building. The Raceway is an open canal downstream of this building before it rejoins the Sudbury River.

All of these drainageways except Chemical Brook culvert comprise the Continuing Source Areas. Chemical Brook culvert is not considered a Continuing Source Area because of the small amounts of sediment in the culvert and the relatively low levels of mercury in that sediment. These drainageways are shown on Figure 3.

C. Contamination of Affected Media

The assessment of Sudbury River and Continuing Source Area contamination was based on the 1989, 1990 and 1991 sampling data. The results of surface water and sediment sampling in the Continuing Source Areas and fish sampling in the Sudbury River are summarized below; additional sampling results can be found in Section 4 of the RI Report.

1. Sediment

- The highest concentrations of mercury in sediments occur in the Eastern Wetland area, which drains the eastern portion of the Site. The average detected level of mercury in this area during the first sampling round was 44.84 ppm with a maximum of 152 ppm. Phase 2 sampling of this area showed that the highest concentrations of inorganic contaminants are in the upper two feet of sediment in this area. Concentrations decrease with depth and approach non-detectable at five to six feet below ground surface.
- As sediments are transported downstream through Chemical Brook culvert to Outfall Creek, mercury concentrations decrease as sediments from other sources are mixed with the contaminated sediment from the Site. However, there is a dramatic rise in mercury concentrations in River sediment where these drainageways (including the Raceway) discharge to the River. Maximum mercury levels in sediment in Trolley Brook and the Outfall Creek/lower Raceway area were 36.5 and 99.2 mg/kg, respectively.
- The maximum mercury concentration found in sediments in Chemical Brook culvert was 7.1 mg/kg.
- Monomethylmercury was found in low levels in two of the Eastern Wetland sediment samples.
- Chromium and aluminum were also found above background levels in the Continuing Source Areas.
- A number of Site-related organic contaminants were detected in the Eastern Wetland sediments in the range of 10[1] to 10[4] ppb. These include chlorobenzene, dichlorobenzene, trichloroethene, and dichloroethene. Concentrations decreased within a short distance downstream of the Eastern Wetland.
- Polynuclear Aromatic Hydrocarbons (PAHs) were detected in sediments in the Eastern Wetland, Chemical Brook Culvert, and Outfall Creek. Most of these PAHs are not considered to be Site-related.

- Occasional occurrences of pesticides were found in sediments in the Eastern Wetland. Pesticides are not related to the Site.

2. Surface Water

- Mercury was detected in surface water samples at levels above the chronic and acute Ambient Water Quality Criteria (0.012 ug/l and 2.4 ug/l, respectively) in the Eastern Wetland and at levels above the chronic Ambient Water Quality Criteria in Outfall Creek and Trolley Brook.

- Chromium occurred at low concentrations in several surface water samples from the Eastern Wetland.

- Lead was detected in surface water samples in the Eastern Wetland, Trolley Brook and Outfall Creek. No distribution pattern was apparent.

- Several other inorganic contaminants, including barium, cobalt and zinc were detected in the Continuing Source Areas at levels above the chronic AWQC. These contaminants are not considered to be Site-related.

- Minimal concentrations (less than 13 ug/l maximum concentration) of volatile organic compounds were detected in the surface water in the Continuing Source Areas.

- Methylmercury was not detected in the surface water.

- One phthalate compound, bis(2-ethylhexyl) phthalate, was detected in one surface water sample in Outfall Creek. This compound is not considered to be related to the Site.

3. Biota/Fish

- No biota samples were collected in the Continuing Source Areas.

- Mercury, including methylmercury, was detected in fish samples collected throughout the Sudbury River.

- Pesticides and PCBs were also detected in several fish samples from the River. These contaminants are not considered to be related to the Site.

- Concentrations of mercury and pesticides, both of which bioaccumulate, were generally higher in older, larger fish and in fish that were higher in the food chain.

A complete discussion of Study Area characteristics can be found in Sections 3 and 4 of the Remedial Investigation Report.

VI. SUMMARY OF SITE RISKS

A Risk Assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site. The results of the public health risk assessment for the OU III of the Site are discussed below followed by the results of the environmental risk assessment.

A. Human Health Risk Assessment

The public health risk assessment followed a four step process: 1) contaminant identification, which identified those hazardous substances which, given the specifics of the Site, were of significant concern; 2)

exposure assessment, which identified exposure pathways and characterized the potentially exposed populations; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and 4) risk characterization, which integrated the three earlier steps to summarize the risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks.

1. Contaminants of Concern

Fifty-seven contaminants of concern, listed in Tables 1 and 2 were selected for evaluation in the risk assessment. These contaminants constitute a representative subset of more than seventy-five contaminants identified in the Study Area during the RI. The fifty-seven contaminants of concern were selected to represent potential Site related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment. A summary of the health effects of each of the contaminants of concern can be found in Section 6.2 of the RI.

2. Exposure Pathways

Potential human health effects associated with exposure to the contaminants of concern were estimated quantitatively through the development of several hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location of the Site. The following is a brief summary of the exposure pathways evaluated.

Under current and expected future land use conditions, the Human Health Risk Assessment assumed that the Study Area, is used for recreational purposes- swimming, boating, wading and fishing.

Surface water exposure scenarios included exposure through wading and swimming which resulted in accidental ingestion of and dermal contact with the surface water. This scenario was evaluated for adult (50 days/year), teenage (150 days/year) and child (50 days/year) receptors.

Sediment exposure scenarios mirrored the surface water scenarios with accidental ingestion and dermal contact being the primary routes of exposure. However, in addition to the recreational scenario, a residential scenario, which assumed more frequent exposure to contaminated sediment was evaluated in some areas. This scenario assumed an exposure frequency of 270 days/year and was evaluated for the bordering wetland areas. Although the Continuing Source Areas were not evaluated in the Risk Assessment for a residential exposure scenario, EPA believes this scenario is appropriate for these areas, due to their proximity to both residential areas and Ashland High School.

Fish ingestion exposure scenarios for the Sudbury River were evaluated for two different receptors- sports and subsistence fishermen. These scenarios were evaluated for an adult who consumes fish 350 days/year over a 30 year period. The sports and subsistence fishermen were assumed to consume 0.054 kg/day and 0.132 kg/day, respectively.

A more thorough description of exposure pathways can be found in Section 6.4 of the RI Report.

For each pathway evaluated, an average and reasonable maximum exposure estimate was generated, corresponding to the average and maximum concentration of contaminants detected in each medium.

3. Toxicity Assessment

An important component of the risk assessment is the relationship between the dose of a compound and the potential for adverse health effects resulting from exposure to that dose. Dose-response relationships provide a means by which potential public health impacts may be evaluated. The toxicity criteria that were used to characterize the public health risk associated with exposure to Contaminants of Concern are explained in Section 6.3 of the RI Report.

4. Risk Characterization

The Human Health Risk Assessment calculated excess lifetime cancer risks for each exposure pathway by multiplying the exposure level with the chemical specific cancer potency factor. Cancer potency factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g. 1×10^{-6} or 1/1,000,000) and indicate (using this example), that an average individual is not likely to have greater than a one in a million chance of developing cancer over 70 years as a result of Site-related exposure as defined by the compound at the stated concentration. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances. For carcinogenic risk, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual between 10^{-4} and 10^{-6} .

The hazard quotient was also calculated for each pathway as EPA's measure of the potential for non-carcinogenic health effects. The hazard quotient is calculated by dividing the exposure level by the reference dose (RfD) or other suitable benchmark for non-carcinogenic health effects for an individual compound. Reference doses have been developed by EPA to protect sensitive individuals over the course of a lifetime and they reflect a daily exposure level that is likely to be without an appreciable risk of an adverse health effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. The hazard quotient is often expressed as a single value (e.g. 0.3) indicating the ratio of the stated exposure as defined to the reference dose value (in this example, the exposure as characterized is approximately one third of an acceptable exposure level for the given compound). The hazard quotient is only considered additive for compounds that have the same or similar toxic endpoints (for example: the hazard quotient for a compound known to produce liver damage should not be added to a second whose toxic endpoint is kidney damage). For non-carcinogenic risk, acceptable exposure levels are generally concentration levels that represent a hazard quotient less than or equal to one.

Table 3 depicts the carcinogenic and non-carcinogenic risk summaries for the contaminants of concern in sediment, surface water and fish evaluated to reflect risks corresponding to the average and the reasonable maximum exposure scenarios for each exposure pathway in each area evaluated.

The following sections summarize the results of the Human Health Risk Assessment as indicated in Table 3.

In addition, Tables 6-9A to 6-47B of the RI Report show the maximum and average concentrations, the exposure factors and the calculated risk for each contaminant of concern, for surface water, sediment, and biota for each River area and for each of the drainageways between the Property and the River, including the Continuing Source Areas.

a. Sediment Exposure Scenarios

1. Carcinogenic Risk

Cancer risk estimates do not exceed 1.3×10^{-4} in any case presented for any of the areas evaluated. The principal contaminants contributing to this risk are not related to the Site. Therefore, there is no excess cancer risk for this scenario from Nyanza contaminants. 2. Non-Carcinogenic Risk The hazard index calculated for chemicals affecting the kidney and/or central nervous system equals one for the Eastern Wetland sediment exposure scenario when the receptor of concern is a child and a recreational exposure scenario is used. The primary contaminant contributing to this risk is mercury. If a residential scenario, which assumes more frequent exposure and which was not evaluated for this area in the Risk Assessment, were considered, the hazard index would be greater than one.

The hazard index for wetlands bordering the River (residential exposure scenario), when calculated on a target organ-specific basis, does not exceed one.

b. Surface Water Exposure Scenarios

1. Carcinogenic Risk

EPA's acceptable risk range for carcinogenic risk is not exceeded for any of the surface water exposure scenarios. 2. Non-Carcinogenic Risk A hazard index of one is not exceeded for any of the surface water scenarios evaluated with the exception of Reservoir 2 where a maximum detection of 19,300 ug/l of selenium resulted in a hazard index of 3.8. This single detection, however, appears to be an anomaly. Furthermore, selenium is not a Site-related contaminant.

c. Fish Ingestion Exposure Scenarios

1. Carcinogenic Risk

-Cancer risks estimated for the fish ingestion scenarios in the Sudbury River range up to 5.5×10^{-3} . The principal contaminants of concern contributing to these risks are arsenic, several pesticides and PCBs. For all of the areas where EPA's acceptable risk range is exceeded for this scenario, the risk range is exceeded for non-Site related contaminants. Therefore, there is no excess cancer risk from Nyanza contaminants for this scenario. 2. Non-Carcinogenic Risk With regard to the fish ingestion scenario, hazard indices exceed one in each of the areas evaluated for at least one of the scenarios. The following is a summary of the locations and scenarios where a hazard index of one is exceeded:

-Sudbury Reservoir (background)

Subsistence fisherman- maximum and average

-Cedar Swamp Pond (background)

Subsistence fisherman- maximum and average

Sport fisherman- maximum

-Southville Pond (background)

Subsistence fisherman- maximum and average

-Mill Pond

Subsistence fisherman- maximum and average

Sport fisherman- maximum

-Reservoir 2

Subsistence fisherman- maximum and average

Sport fisherman- maximum and average

-Reservoir 1

Subsistence fisherman- maximum and average

Sport fisherman- maximum

-Saxonville Impoundment

Subsistence fisherman- maximum and average

Sport fisherman- maximum

-Fairhaven Bay

Subsistence fisherman- maximum and average
Sport fisherman- maximum

Mercury, for which the toxic endpoints are the central nervous system and the kidney, is the primary contaminant contributing to the risk in these scenarios. The hazard quotient for mercury and/or methylmercury exceeds one in every case that the hazard index exceeds one.

5. Uncertainties in Estimating Risk

It should be emphasized that the risk estimates in this assessment are based on numerous assumptions, each having uncertainty associated with it. Several types of uncertainties should be considered in any risk evaluation:

- uncertainties associated with identifying contaminants of concern and estimating average exposures;
- uncertainties associated with estimating the frequency, duration and magnitude of exposure;
- uncertainties in the models used to characterize risk;
- uncertainties in estimating carcinogenic potency factors and/or non-carcinogenic measures of toxicity (e.g., RfDs).

A complete discussion of these uncertainties is located in Section 6.7 of the RI Report.

B. Ecological Risk Assessment

The ecological risk assessment was conducted using methodology similar to the human health risk assessment except that, in the ecological assessment, the receptors of concern are plants and animals other than humans. The methodology and results of the Ecological Risk Assessment can be found in more detail in Chapter 7 of the RI Report.

1. Contaminants of Concern

Thirty-six contaminants of concern, listed in Table 4, were selected for evaluation in the ecological risk assessment. These contaminants constitute a subset of more than seventy-five contaminants identified in the Study Area during the RI. The thirty-six contaminants of concern were selected to represent potential Site-related hazards based on concentration, frequency of detection, toxicity, bioconcentration potential, or environmental persistence.

2. Exposure Assessment

The exposure assessment identifies a number of exposure pathways for evaluation in the ecological risk assessment. These pathways are shown in Figure 4. These exposure scenarios evaluate the following:

- effect on plants and animals that live in the surface water;
- effect on animals that live in the sediment;
- effect on animals that feed on fish or river animals.

Indicator species were selected for each of the exposure pathways based on a number of factors including relevance for the Site (i.e. the species is known to occur at the Site) and position in the food chain (as a measure of bioaccumulation).

The second component of the exposure assessment includes the estimation of

environmental concentrations (EECs) for Contaminants of Concern for each exposure pathway (surface water, sediment and biota). The development of the EECs is based on measured concentrations of contamination at the Site, and an understanding of chemical fate and transport, which is described in Section 5.0 of the RI Report. Average and maximum EECs were calculated for each Contaminant of Concern for each media.

3. Hazard Assessment

The hazard assessment identifies concentrations of Contaminants of Concern for the appropriate exposure pathway that are known to or are likely to result in adverse effects to biota. Most toxicity data are based on standard test species that are representative of similar, related species that might exist within the Study Area. Little or no data are available in the literature measuring direct toxicity of the Contaminants of Concern to the indicator species selected for this Site.

4. Risk Characterization

Although many inorganic and organic chemicals were detected in various media within the Study Area, only a few chemicals were found at concentrations that would be considered to pose a risk to ecological receptors. The primary media of concern were determined to be sediments and biota. Risks from surface water appear to be minimal in comparison to those from sediments and biota, with the exception of the Eastern Wetland, Trolley Brook and Outfall Creek where risks from surface water are more substantial. However, risks due to bioaccumulation from contaminants at levels in surface waters below the current detection limits will be further investigated as part of the additional studies to be conducted on the River under OU IV.

a. Surface Water Scenarios

Contaminant levels above the Ambient Water Quality Criteria (AWQC) were considered to be of concern in this evaluation. Based on current data, mercury exceeded the chronic AWQC of 0.012 ug/l in the Eastern Wetland, Trolley Brook and Outfall Creek. In addition, the acute AWQC of 2.4 ug/l was exceeded in the Eastern Wetland. Several other compounds, particularly lead, also infrequently exceeded the AWQC.

b. Sediment Scenarios

Mercury constituted a major portion of the estimated risk from contaminated sediments. The concentration of mercury found in the Eastern Wetland, Outfall Creek, and many of the River locations exceeded levels reported by the National Oceanic and Atmospheric Administration at which undesirable effects were frequently observed amongst most types of aquatic sediment dwelling animals (ER-M).

Other Site-related contaminants, particularly chromium and lead, were occasionally found at levels that may be harmful to animals in the sediment. However, these contaminants constitute less of a risk to ecological receptors than mercury primarily because they do not bioaccumulate.

The risk estimates for exposure to aluminum in the sediments, which is not considered to be a Site-related contaminant, were also high throughout the river system.

c. Bioaccumulation of Contaminants through the Food Chain

The predominant contaminant of concern for biota was mercury, followed by PCBs and DDT and its degradation products (DDD and DDE), which are not considered to be Site-related contaminants. The contaminants which resulted in the greatest risk are those that have the greatest effects on food chains/webs due to their high potential for bioaccumulation. The toxicity

hazards associated with these contaminants are minimal compared to the risk associated with exposure through the food chain.

The greatest risk from exposure to contaminants through the food chain from Site contaminants is to upper trophic level predators that ingest contaminated fish and invertebrates from the Sudbury River and the Continuing Source Areas. The harmful effects to animals at all levels of the food chain include death, reproductive failure, central nervous system effects, and behavioral modification.

5. Uncertainties in Estimating Risk

As in the Human Health Risk Assessment, it should be emphasized that the risk estimates in the Ecological Risk Assessment are based on numerous assumptions, each having uncertainty associated with it. These uncertainties are similar to those discussed for the Human Health Risk Assessment above and are summarized in more detail in Section 7.6.6 of the RI Report.

c. Primary Risks from Site-related Contaminants

A number of contaminants, both Site- and non-Site related are found in the Continuing Source Areas and in the Sudbury River. However, cleanup levels were evaluated only for mercury for several reasons. First, it is one of the only contaminants which showed a clear connection to the Site. In addition, mercury is the primary Site-related contaminant contributing to both human health and ecological risk due, in part, to its propensity to bioaccumulate.

Mercury concentrations in sediments are significantly higher in the Continuing Source Areas than in the River areas. In addition to the risk resulting from these contaminated sediments, these sediments are expected to continue to migrate to the Sudbury River, providing a continuing source to the River. Based on the human health and ecological risks associated with these areas, the potential for continued migration of contaminated sediments from these areas to the River, and the inability to evaluate the effectiveness of River remediation using current data, EPA has focused this remedy on the Continuing Source Areas. Additional studies under OU IV will address River contamination.

D. Conclusion

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. Risks due to contamination in the sediment and surface water in the Continuing Source Areas are dealt with in this ROD. In addition, through the use of institutional controls, risks due to fish ingestion in the Sudbury River are also temporarily addressed in this ROD.

VII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. Statutory Requirements/Response Objectives

Under its legal authorities, EPA's primary responsibility at Superfund Sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with all Federal and more stringent state environmental standards, requirements, criteria or

limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives were developed to aid in the development and screening of alternatives. These remedial action objectives were developed to mitigate existing and future potential threats to public health and the environment. These response objectives were:

Human Health Objectives

1. Mitigate mercury contamination in sediment in areas where accidental ingestion and dermal contact with contaminated sediments may result in unacceptable human health risks.
2. Mitigate mercury contamination in sediment in order to reduce mercury levels in fish, which may be consumed by fishermen.
3. Mitigate mercury contamination in sediment in the Continuing Source Areas in order to prevent continued migration of contamination to the Sudbury River.

Ecological Objectives

1. Mitigate mercury contamination in sediment to achieve an increased level of protection to environmental receptors in the Continuing Source Areas; one which is approximately equal to that found in background areas.
2. Mitigate mercury contamination in sediment in Continuing Source Areas in order to prevent continued migration of contamination to the Sudbury River.
3. Restore any wetland habitat disturbed during remediation.

B. Technology and Alternative Development and Screening

CERCLA and the NCP set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives was developed for the Study Area.

The first OU addressed the primary source control at the Site through the excavation, consolidation, and capping of on-Site soils, sludges and sediments. The second OU addresses management of migration through an interim remedy to pump and treat contaminated groundwater. The remedy selected in this ROD provides additional source control through remediation of the Continuing Source Areas.

With respect to OU III source control, the RI/FS developed a range of alternatives in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances in the Continuing Source Areas is a principal element. This range included an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing the need for long term management. This range also included alternatives that treat the principal threats posed by the Site but vary in the degree of treatment employed and the quantities and characteristics of

the treatment residuals and untreated waste that must be managed; alternative(s) that involve little or no treatment but provide protection through engineering or institutional controls; and a no action alternative.

As discussed in Chapters 4 and 5 of the FS, the RI/FS identified, assessed and screened technologies based on implementability, effectiveness, and cost. These technologies were combined into source control alternatives. Chapter 5 of the FS presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories identified in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated and screened in Chapter 6 of the FS and in the FS Addendum Report.

In summary, of the 13 source control remedial alternatives screened in Chapter 5, six were retained for detailed analysis. Table 5 identifies the six alternatives that were retained through the screening process, as well as those that were eliminated from further consideration.

VIII. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of each alternative evaluated. The alternatives evaluated include a no action alternative (Alternative 1), a limited action alternative (Alternative 2), as well as a series of remediation alternatives for the Continuing Source Areas.

Alternatives that required active remediation of River Areas were eliminated in OU III because of an inability to evaluate their effectiveness using current data, the potential for adverse impacts during remediation, and the inordinately high costs associated with these alternatives. All of the alternatives which consider remediation in the Continuing Source Areas also include institutional controls as an interim remedy for the Sudbury River. These temporary controls will be implemented as part of the selected remedy until a final remedy decision is made for the River under OU IV, which EPA has initiated to further investigate the River.

Source Control Alternatives Analyzed

Alternative 1: No Action with Monitoring

The FS evaluated this alternative to serve as a baseline for comparison with the other remedial alternatives under consideration. No work would be performed to address sediment contamination in the Continuing Source Areas or River Areas. Annual monitoring of sediment, surface water, and fish would be conducted for 30 years or until a final remedy decision is made for the River under OU IV.

Estimated Time for Implementation: Not applicable
Estimated Capital Cost: \$0
Estimated Annual O&M Cost: \$420,670
Estimated Total Cost (net present worth): \$6,893,000

Alternative 2: Limited Action (No Action with Institutional Controls and Monitoring)

This alternative is identical in scope to Alternative 1, except that it adds institutional controls and measures to enhance public awareness.

The FS evaluated this alternative for both the Continuing Source Areas and for the River Areas containing mercury-contaminated sediments. Components

common to both areas include posting signs warning against consumption of fish; conducting a public awareness program; and annual sampling of surface water, sediments, and biota to evaluate contaminant levels and migration. In addition, for the Continuing Source Areas, a fence would be installed around the Eastern Wetland, Trolley Brook and Outfall Creek, extending along the lower Raceway to the confluence with the Sudbury River. For the River Areas, EPA would recommend that the Massachusetts DPH advisory against consuming Sudbury River fish be maintained throughout the River.

Estimated Time for Implementation: 4 months
Estimated Capital Cost: \$286,789
Estimated Annual O&M Cost: \$449,770
Estimated Total Cost (net present worth): \$7,626,000

Alternative 3: Dredging, Treatment by Solvent Extraction/Soil Washing, Redeposition of Sediment, Wetland Restoration and Institutional Controls

This alternative would include dredging sediments from the Continuing Source Areas and treating them on-Site with a solvent extraction/soil washing process; off-Site disposal of the treatment residuals; treating the resulting wastewater, if necessary, and discharging it on-Site; redepositing the treated sediments in the excavated areas; restoring impacted wetland areas; evaluating and implementing institutional controls for the River Areas until a final remedy decision is made in these areas; preparing and implementing a plan for increased public awareness regarding River contamination; and creating a fourth OU to perform additional studies on sediment and fish in the Sudbury River to determine a sediment cleanup level that would lower risks to human health and the environment in the River Areas. Treatability testing would be necessary under this alternative to determine the optimal treatment methods and the effectiveness of the treatment technology.

Three target cleanup goal concentrations were examined for this alternative, as follows:

Alternative 3A incorporated a target cleanup goal of 1 mg/kg of mercury in sediment, which is the background level in upstream reaches of the River unaffected by releases from Nyanza. This target cleanup goal is protective of human health and the environment and is expected to eliminate future migration of mercury to the Sudbury River. The volume of contaminated sediment to be excavated and treated under this alternative is estimated to be approximately 20,206 cubic yards.

Estimated Time for Implementation: 19 months
Estimated Capital Cost: \$17,254,081
Estimated Annual O&M Cost: \$449,770[2] <Footnote>2 The actual annual Operation and Maintenance costs for this alternative will be substantially less than the estimated costs noted here. The majority of these annual costs (approximately \$390,000) are for sampling and analysis activities in the Sudbury River which will not be conducted as Operation and Maintenance for this remedy. Instead, sampling and analysis will be conducted during OU IV investigations and a final monitoring plan for the Sudbury River will be included as part of the OU IV remedy decision. In addition, the institutional controls which will be implemented as part of OU III (e.g. sign maintenance and public awareness activities) are an interim remedy only, pending the OU IV remedy decision. Therefore, these activities will be conducted for a much shorter period than the 30 years calculated in the FS. The only Operation and Maintenance costs associated with OU III are the costs associated with ensuring the long-term effectiveness of the wetland restoration program. Thus, the longterm costs of this remedy are expected to be far less than the 30-year cost estimate, closer, in fact, to the

capital costs.</footnote> Estimated Total Cost (net present worth):
\$24,593,000

Alternative 3B incorporated a target cleanup goal of 7 mg/kg of mercury in sediment, a concentration estimated to reduce mercury concentrations in fish in the Sudbury River to levels protective of human health from occasional ingestion of mercury-contaminated fish by sports fishermen. This target cleanup goal would be protective of humans exposed to contaminated sediment through dermal contact or accidental ingestion for a residential exposure scenario, but would not be protective of environmental receptors. The volume of contaminated sediment to be excavated and treated under this alternative is estimated to be approximately 11,186 cubic yards.

Estimated Time for Implementation: 14 months
Estimated Capital Cost: \$10,618,228
Estimated Annual O&M Cost: \$449,770[3] <Footnote>3 See footnote
2.</footnote> Estimated Total Cost (net present worth): \$17,957,000

Alternative 3C incorporated a target cleanup goal of 30 mg/kg of mercury in sediment, a concentration that is protective of humans exposed to contaminated sediment by dermal contact or accidental ingestion for a residential exposure scenario, but is not protective of environmental receptors. The volume of contaminated sediment to be excavated and treated under this alternative is estimated to be approximately 3,604 cubic yards.

Estimated Time for Implementation: 6 months
Estimated Capital Cost: \$4,745,362
Estimated Annual O&M Cost: \$449,770[4] <Footnote>4 See Footnote
2.</footnote> Estimated Total Cost (net present worth): \$12,084,000

Alternative 4: Dredging, Solidification, Off-Site Disposal, Wetlands Restoration and Institutional Controls

This alternative includes dredging sediments from the Continuing Source Areas; stabilizing/solidifying the sediments on-Site and disposing of them off-Site; treating the resulting wastewater, if necessary, and discharging it on-Site; restoring impacted wetland areas; evaluating and implementing institutional controls for the River Areas until a final remedy decision is made in these areas; preparing and implementing a plan for increased public awareness regarding River contamination; and creating a fourth OU to perform additional studies on sediment and fish in the Sudbury River to determine a sediment cleanup level that would lower risks to human health and the environment for River Areas.

Three target cleanup goal concentrations were examined for this alternative, as follows:

Alternative 4A incorporated a target cleanup goal of 1 mg/kg of mercury in sediment, which is the background level in upstream reaches of the River unaffected by releases from Nyanza. This target cleanup goal is protective of human health and the environment and is expected to eliminate future migration of mercury to the Sudbury River. The volume of contaminated sediment to be excavated, stabilized and disposed off-Site under this alternative is estimated to be approximately 20,206 cubic yards.

Estimated Time for Implementation: 19 months
Estimated Capital Cost: \$40,460,444
Estimated Annual O&M Cost: \$449,770[5] <Footnote>5 See footnote
2.</footnote> Estimated Total Cost (net present worth): \$47,799,000

Alternative 4B incorporated a target cleanup goal of 7 mg/kg of mercury in

sediment, a concentration estimated to reduce mercury concentrations in fish in the Sudbury River to levels protective of human health from occasional ingestion of mercury-contaminated fish by sports fishermen. This target cleanup goal would be protective of humans exposed to contaminated sediment through dermal contact or accidental ingestion for a residential exposure scenario but would not be protective of environmental receptors. The volume of contaminated sediment to be excavated, stabilized and disposed off-Site under this alternative is estimated to be approximately 11,186 cubic yards.

Estimated Time for Implementation: 14 months
Estimated Capital Cost: \$23,327,516
Estimated Annual O&M Cost: \$449,770[6] <Footnote>6 See footnote
2.</footnote> Estimated Total Cost (net present worth): \$30,667,000

Alternative 4C incorporated a target cleanup goal of 30 mg/kg of mercury in sediment, a concentration that is protective of humans exposed to contaminated sediment by dermal contact or accidental ingestion for a residential exposure scenario, but is not protective of environmental receptors. The volume of contaminated sediment to be excavated, stabilized and disposed offSite under this alternative is estimated to be approximately 3,604 cubic yards.

Estimated Time for Implementation: 6 months
Estimated Capital Cost: \$8,500,246
Estimated Annual O&M Cost: \$449,770[7] <Footnote>7 See footnote
2.</footnote> Estimated Total Cost (net present worth): \$15,839,000

Alternative 11: Dredging, Disposal in OU I Cell, Wetlands Restoration, and Institutional Controls

This alternative includes dredging and dewatering of contaminated sediments from the Continuing Source Areas; placing dredged sediments under a portion of the cap constructed in OU I of the Site; treating, if necessary, water from the dewatering process and discharging it to an on-Site surface water body; restoring impacted wetland areas; evaluating and implementing institutional controls for River Areas until a final remedy decision is made in these areas; preparing and implementing a plan for increased public awareness regarding River contamination until a final remedy decision is made; and creating a fourth OU to perform additional studies on sediments and fish in the SudburyRiver to determine a sediment cleanup level that would lower risks to human health and the environment for River Areas.

As in Alternatives 3 and 4, EPA evaluated three target cleanup goal concentrations for this alternative, as follows:

Alternative 11A is the selected alternative and is discussed in Section X of this ROD.

Alternative 11B incorporated a target cleanup goal of 7 mg/kg of mercury in sediment, a concentration estimated to reduce mercury concentrations in fish in the Sudbury River to levels protective of human health from occasional ingestion of mercury-contaminated fish by sports fishermen. This target cleanup goal would be protective of humans exposed to contaminated sediment through dermal contact or accidental ingestion for a residential exposure scenario but would not be protective of environmental receptors. The volume of contaminated sediment to be excavated and disposed of under the OU I cap for this alternative is estimated to be approximately 11,186 cubic yards.

Estimated Time for Implementation: 14 months
Estimated Capital Cost: \$8,161,994
Estimated Annual O&M Cost: \$449,770[8] <Footnote>8 See footnote

2.</footnote> Estimated Total Cost (net present worth): \$15,501,000

Alternative 11C incorporated a target cleanup goal of 30 mg/kg of mercury in sediment, a concentration that is protective of humans exposed to contaminated sediment by dermal contact or accidental ingestion for a residential exposure scenario, but is not protective of environmental receptors. The volume of contaminated sediment to be excavated and disposed of under the OU I cap for this alternative is estimated to be approximately 3,604 cubic yards.

Estimated Time for Implementation: 7 months

Estimated Capital Cost: \$4,038,798

Estimated Annual O&M Cost: \$449,770[9] <Footnote>9 See footnote

2.</footnote> Estimated Total Cost (net present worth): \$11,378,000

Alternative 13: Diverting Flow from the Eastern Wetland to a Constructed Sedimentation Basin, and Institutional Controls

This alternative, which is evaluated in the FS Addendum, would include redirecting discharge from the Eastern Wetland to a concrete sedimentation basin, located in the Trolley Brook Wetland; evaluating and implementing institutional controls for the River Areas and the Continuing Source Areas; preparing and implementing a plan for increased public awareness regarding contamination; and creating a Fourth OU to perform additional studies on sediment and fish in the Sudbury River and some of the Continuing Source Areas (Trolley Brook, Cutfall Creek and the Raceway) to determine a sediment cleanup level that would lower risks to human health and the environment for these areas. Maintenance of the sedimentation basin would include quarterly removal, treatment and disposal of accumulated sediments.

Target cleanup goals are not applicable to this alternative. This alternative would result in decreased migration of contaminated sediments from the Eastern Wetland to the Sudbury River. However, due to space constraints, a basin equipped to handle storm flows cannot be constructed in this area. Therefore, storm flows would need to bypass the sedimentation basin, resulting in migration of sediment during storm events.

In addition, this alternative is expected to have only minimal benefit in protecting human health and the environment. Through the accumulation and eventual removal of sediments from the basin, there will be, over the long term, a decrease in exposure to the contaminants. In the meantime, however, this alternative does not prevent human or ecological exposure to the contaminated sediments.

Estimated Time for Implementation: 3 months

Estimated Capital Cost: \$756,749

Estimated Annual O&M Cost: \$521,620[10] <Footnote>10 See footnote

2.</footnote>

Estimated Total Cost (net present worth): \$9,200,000

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

A. Introduction

Section 121(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a remedy for this OU. These criteria are summarized as follows:

Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP.

1. Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.
2. Compliance with applicable or relevant and appropriate requirements (ARARs) addresses whether or not a remedy will meet all of the ARARs of other Federal and State environmental laws and/or provide grounds for invoking a waiver.

Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria.

3. Long-term effectiveness and permanence addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.
4. Reduction of toxicity, mobility, or volume through treatment addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site.
5. Short term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.
6. Implementability addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.
7. Cost includes estimated capital and Operation Maintenance (O&M) costs, as well as present-worth costs.

Modifying Criteria

The modifying criteria are used on the final evaluation of remedial alternatives generally after EPA has received public comment on the RI/FS and Proposed Plan.

8. State acceptance addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.
9. Community acceptance addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report.

A detailed analysis of each alternative compared to the nine criteria can be found in Section 6 of the FS Report.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis is summarized in the Table 6-15 of the FS and in Sections A.1.1.1

to A.1.1.7 in the FSAddendum.

B. Threshold Criteria

1. OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternatives 1 and 2 provide no significant reduction in risk to humans or the environment. Alternative 1 (No Action with Monitoring) would not eliminate, reduce or control any of the risks posed by the contaminants in the Continuing Source Areas or in the River. Alternative 2, which adds Institutional Controls, may control some of the risks to human health, although it should be noted that EPA has little experience in implementing institutional controls over long periods of time. Furthermore, institutional controls would not eliminate, reduce or control any risks to environmental receptors.

While the current and future risks from dermal contact or ingestion in the Continuing Source Areas are acceptable for a recreational exposure scenario (i.e., 50 days/year), the risks are unacceptable under a residential exposure scenario (i.e., 270 days/year). Due to the proximity of both residential areas and Ashland High School to the Continuing Source Areas, EPA believes the more conservative residential exposure scenario is appropriate for these areas.

In addition, the risks to both human and ecological receptors in the River areas are likely to increase over time due to the continued migration of contaminants from the Continuing Source Areas to the River. Thus, Alternatives 1 and 2 would not be protective of either human health or the environment.

The selected alternative, 11A, as well as other alternatives with a cleanup level of 1 mg/kg of mercury (3A and 4A), would be protective of humans exposed to Continuing Source Area sediments through direct contact or ingestion for both residential and recreational exposure scenarios. These 'A' alternatives would also provide protection to environmental receptors in the Continuing Source Areas based on data in the National Oceanic and Atmospheric Administration's "The Potential for Biological Effects of Sediment Sorbed Contaminants Tested in the National Status and Trends Program" (NOS OMA 52). These data show that the ER-M, the contaminant level above which adverse effects to ecological receptors are expected, is 1.3 ppm for mercury in sediment.

The 'B' and 'C' alternatives (3B, 4B, 11B, 3C, 4C, and 11C), with cleanup levels of 7 mg/kg and 30 mg/kg of mercury, respectively, would be protective of humans exposed to Continuing Source Area sediments through direct contact or ingestion for both residential and recreational exposure scenarios. However, these alternatives would not be protective of ecological receptors because mercury levels remaining in sediments would exceed the 1.3 ppm ER-M.

Alternative 13 provides only a minimal reduction of the risk to human health from the sediment exposure scenarios through the removal of small amounts of contaminated sediment during maintenance of the sedimentation basin. Throughout implementation of this alternative, both human and ecological receptors would continue to be exposed to contaminated sediments and surface water.

With regard to risks in River Areas, the 'A' alternatives (with a cleanup goal of 1 mg/kg of mercury in the Continuing Source Areas), including the preferred alternative, would result in the greatest decrease in the migration of contaminated sediments to the Sudbury River and, thereby, prevent risks from increasing. The 'B' alternatives (with a cleanup goal of

7 mg/kg of mercury in the Continuing Source Areas) would be expected to have a lesser effect in preventing an increase in risk in the River. Alternatives 3C, 4C, and 11C (with a cleanup goal of 30 mg/kg of mercury in the Continuing Source Areas) and Alternative 13 would provide the smallest decrease in migration of contaminated sediments to the River and therefore would have the least impact in preventing River contamination from increasing.

The control of risk to humans in River Areas under all alternatives (except Alternative 1) would rely on institutional controls and public awareness activities until such time as a final remedy is selected under OU IV. Human exposure to highly contaminated sediments in the River areas is unlikely due to the fact that highly contaminated sediments in the River are generally under 8-10 feet of water. Risks to human health through consumption of fish from the River will be controlled through maintenance of warning signs and other measures to increase public awareness. While institutional controls and public awareness activities will not provide any reduction in risk to environmental receptors in the River Areas, these disadvantages are mitigated by the fact that the controls will only be in place until a final remedy for the River is implemented under OU IV.

2. COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Neither Alternative 1 nor 2 would meet all ARARs. The Ambient Water Quality Criteria (AWQC) for mercury are currently exceeded in the Eastern Wetland, Trolley Brock and Cutfall Creek. Under the No Action alternative and the limited action alternative, these criteria would continue to be exceeded in these areas since there would be no decrease in the amount of mercury released from contaminated sediments into the surface water.

The selected alternative, 11A, and Alternatives 3A and 4A, which call for the excavation of sediments exceeding 1 mg/kg mercury, are expected to result in surface water mercury levels below the AWQC. The regression analysis conducted in the FS calculated that a value of 4.5 mg/kg mercury in sediment may result in surface water levels below the AWQC. Although this value is based on a low correlation coefficient, EPA expects that the cleanup level of 1 mg/kg of mercury in sediments, which is considerably below this value, will result in surface water in the Continuing Source Areas that meets AWQC. Furthermore, in implementing these alternatives, all chemical-, location-, and action-specific ARARs for the Continuing Source Areas can be met.

Alternatives 3B, 3C, 4B, 4C, 11B and 11C are not expected to meet the AWQC since higher levels of contamination remaining in the sediment after remediation will allow more partitioning of contaminants into the surface water.

Alternative 13 is not expected to have any significant effect on the levels of mercury in the surface water since contaminated sediments will not be excavated. The diversion of surface water outflow from the Eastern Wetland to a sedimentation basin will not prevent the continued partitioning of mercury from sediments to surface water and, therefore, this alternative is not expected to meet the AWQC. In addition, implementation of Alternative 13 would fail to comply with wetlands ARARs. This alternative includes the construction of a sedimentation basin into which surface water outflow from the Eastern Wetland will be diverted. Because of Site limitations, the only land available for construction of a sedimentation basin is a wetland area. Since the sedimentation basin would be in place for many years, this alternative would result in long term destruction of wetlands in violation of federal (Clean Water Act 404 and associated regulations; Executive Order

11990) and State (Massachusetts Wetland Protection Act and associated regulations) requirements which mandate minimization of loss or degradation of wetlands.

In summary, only alternatives 3A, 4A and 11A satisfy both threshold criteria of Overall Protection and Compliance with ARARs. These alternatives are compared below using the balancing and modifying criteria. All other alternatives have been eliminated from further consideration since they failed to satisfy one or both of the threshold criteria.

C. Balancing Criteria

1. LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 11A (the selected alternative) and Alternatives 3A and 4A, are equally effective over the long-term in that they would leave no contaminated sediment above background levels in the Continuing Source Areas. The magnitude of residual risk from untreated wastes in these areas is equal for all three alternatives.

All of the 'A' Alternatives require land disposal of contaminated materials and vary only in the volume and toxicity of these materials. The selected alternative provides for land disposal of untreated sediments under the impermeable cap constructed under OU I. This cap will provide a barrier against exposure to contaminated sediments to both human and ecological receptors. Periodic Site visits and maintenance will be performed to ensure the integrity of the cap and its effectiveness in preventing exposure to contaminated sediments. Alternative 3A would treat contaminated sediments through a solvent extraction/soil washing technology which would result in a smaller volume of more highly contaminated material that would be shipped off-Site for land disposal. Alternative 4A would use solidification/stabilization to treat contaminated sediment. This treatment would likely result in a larger volume of less concentrated material which would be shipped off-Site for disposal. Therefore, upon comparison, these alternatives are equivalent in the long-term effectiveness and permanence they afford.

All of the A alternatives rely on institutional controls and public awareness activities to control risk to humans in the River Areas until a final remedy is implemented for OU IV. These controls do not provide any increase in protection to environmental receptors in the River and, because EPA has little experience in implementing institutional controls over long periods of time, it is not known whether these controls are reliable over the long term. This disadvantage, however, is mitigated by the fact that the controls would only be in place until a final remedy is implemented under OU IV. Because all of the 'A' alternatives would involve institutional controls and public awareness activities, the effects of these measures on long-term effectiveness are equal for all these alternatives.

2. REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative 3A would permanently reduce the volume of contaminated sediments through treatment of these sediments. However, because there is currently no destructive treatment for metals, this treatment alternative would result in a smaller volume of more toxic material (treatment residuals) which would need to be disposed of off-Site.

Alternative 4A would permanently reduce the mobility and toxicity of the sediments through treatment but is likely to result in an increase in volume due to the solidification/stabilization treatment which may be necessary prior to off-Site disposal.

Alternative 11A, the selected alternative, does not include any treatment.

3. SHORT-TERM EFFECTIVENESS

For the selected alternative, 11A, and Alternatives 3A and 4A, short-term effects are similar: construction and traffic congestion, including possible construction of a water treatment facility to treat water from the dewatering process; exposure of on-Site workers to contaminants in excavated sediments; and temporary disturbance of wetlands, wildlife habitat and the aquatic community. These impacts would be mitigated by (1) minimizing, to the extent possible, off-Site construction activities and off-Site movement of construction vehicles; (2) implementation of on-Site worker protection measures, as needed; (3) protection of the aquatic community through the use of silt curtains and/or sedimentation basins; and (4) restoration of wetlands, wildlife habitat and the aquatic community at the conclusion of remedial activities. Furthermore, alternatives 3A and 4A would have all of the short term impacts stated above, but would have additional potential impacts due to the construction of a sediment treatment plant on or near the Property and transportation of contaminated materials off-Site to an appropriate disposal facility. Alternative 4A would require the greatest amount of contaminated materials to be transported off-Site to a disposal facility.

4. IMPLEMENTABILITY

The selected alternative, 11A, is the most easily implemented. It is technically feasible, requires limited land area for implementation, and requires little specialized equipment or materials. Furthermore, because the location for disposing the excavated sediment is the cell constructed in the OU I cap, no off-Site landfill capacity need be obtained. Alternatives 3A and 4A are technically feasible but require specialized equipment and operators, and may not be administratively feasible if significant land acquisition and permitting are necessary. Land availability in the vicinity of the Nyanza Property is limited because most of the Property is either wetland area or is already being utilized for active industrial uses. In addition, Alternatives 3A and 4A will require off-Site landfill capacity for disposal of sediment treatment residuals; the capacity needed for Alternative 4A is greater.

5. COST

The capital, operation and maintenance, and total cost for each 'A' alternative is provided as part of the Description of Alternatives in Sections VIII and X of this ROD. It should be noted, however, that the Operation and Maintenance costs for these alternatives assume 30 years of Operation and Maintenance estimated at approximately 6.8 to 7.3 million dollars (net present worth). These Operation and Maintenance costs were calculated in the FS to include activities such as annual monitoring and institutional controls for the Sudbury River. However, because investigations under OU IV will be performed concurrently with the implementation of the OU III remedy, monitoring of the River will be conducted as part of these OU IV investigations. In addition, institutional controls are an interim remedy only, pending the OU IV remedy decision. Therefore, these costs are expected to be far less than the 30-year cost estimate.

Of the 'A' alternatives, the selected alternative, 11A, is the least expensive at \$20,419,000 and is the most cost-effective since it achieves a protective clean-up level at the smallest cost. Alternative 3A is the next most expensive at \$24,593,000, while 4A is the most costly alternative at

\$47,799,000.

Table 6 summarizes the total cost and operation and maintenance costs for each alternative as estimated in the FS. In addition, this table shows the cost of the remedy excluding operation and maintenance costs because the actual total costs (net present worth) are expected to be closer to the estimated capital costs for the reasons explained above.

D. Modifying Criteria

1. STATE ACCEPTANCE

Based on its review of the RI/FS and Proposed Plan, the Commonwealth of Massachusetts concurs with the selected remedy. A copy of the declaration of concurrence is attached as Appendix B.

2. COMMUNITY ACCEPTANCE

Comments received from the Ashland community indicated a concern about the capacity under the OU I cap and the risks associated with opening the cap. Comments also indicated a preference for the No Action or the Solvent Extraction/Soil Washing Alternative (3A or 3B) for the Continuing Source Areas. Those recommending No Action felt there wasn't enough information to determine the presence of a human health or ecological risk from these areas. Comments received from the downstream communities indicated support for remediation of the Continuing Source Areas in combination with additional studies on the Sudbury River. Responses to community comments are located in Appendix A.

X. THE SELECTED REMEDY

EPA has chosen Alternative 11A as the selected alternative. Alternative 11A is a source control remedy which addresses the threat to human health and the environment posed by exposure to contaminated sediments in the Continuing Source Areas. This remedy will also reduce the continued migration of contaminants to the Sudbury River. In addition, EPA will perform additional studies of the Sudbury River under OU IV, after which a final remedy for the River will be selected. Finally, institutional controls, which will be implemented as part of this remedy, are an interim remedy only, pending the final OU IV remedy decision.

A. Cleanup Levels

A number of contaminants, both Site- and non-Site related, are found in the Continuing Source Areas and in the Sudbury River. However, cleanup levels were evaluated only for mercury for several reasons. First, it is the only contaminant which showed a clear connection to the Site. In addition, mercury is the primary Site-related contaminant contributing to both human health and ecological risk.

The mercury cleanup level of 1 mg/kg was selected for the Continuing Source Areas in order to be protective of human health and the environment for a variety of exposure scenarios. This cleanup level is approximately equal to concentrations of mercury found at locations upgradient of the Site. In addition, this cleanup level reduces mercury levels approximately to the median biological effects level (ER-M) reported by NOAA in "The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program" (NOS OMA 52). This ER-M, the contaminant level above which adverse effects to ecological receptors are expected, is 1.3 ppm for mercury in sediment. A level of 1 mg/kg of mercury is also protective for human health through exposure via accidental

ingestion and dermal contact for all exposure scenarios. Remediation to this clean-up level is expected to result in a hazard index of less than one for these exposure scenarios. This cleanup level is also expected to prevent the risks in the River from increasing by decreasing the levels of mercury migrating to the Sudbury River.

This cleanup level will be met at the completion of the remedial action throughout the Continuing Source Areas. This cleanup level attains EPA's risk management goal for remedial actions and has been determined by EPA to be protective.

B. Costs of Selected Alternative:

The costs of this remedial alternative are:

Estimated Capital Cost: \$13,080,276

Estimated Annual Operation and Maintenance Cost (net present worth): \$449,770[11] <Footnote>11 See footnote 2.</footnote>

Estimated Total Cost (net present worth) \$20,419,000[12] <Footnote>12 See footnote 2.</footnote>

C. Description of Remedial Components

Major components of the selected remedy are described below.

1. Site Preparation

Site preparation activities would be initiated with the construction of access roads necessary for the mobilization and use of excavation, transportation and disposal equipment. Roadway construction would be performed to minimize wetland impacts. Exact locations of the access roads shall be determined in Remedial Design.

The Site preparation includes the establishment of security and controlled access to the Site, the connection of light and power utilities and the furnishing of sanitary facilities. A chain link fence will be constructed around the perimeter of the areas to be remediated. To the maximum extent feasible, existing fences will be utilized. Warning signs will be posted at 100 foot intervals along the fences and at the entrance gates.

Site preparation work will also include provisions for controlling Site drainage. In general, diversion ditches will be used to ensure proper drainage of stormwater away from contaminated areas. Erosion control in the form of silt fencing will be used to prevent uncontrolled movement of contaminated sediments. Stormwater management and erosion control measures to be used during excavation activities are also considered part of the Site preparation work.

Because these activities may include sediment movement, an air monitoring program will be implemented during the performance of the Site preparation work to determine risks to on-Site workers and nearby residents. In addition, subsequent to Site preparation work but prior to sediment excavation activities, sediment monitoring will be performed to further define contaminant levels in any area impacted by Site preparation work.

If necessary, this component of the remedy will utilize measures to limit potential air emissions from excavation activities, including the following methods: enclosure of the work areas; emission suppression techniques (e.g. foam, water spray); and containment of excavated sediments.

Following the installation of erosion control structures, clearing and grubbing will be performed on the densely vegetated areas needed for

implementation and construction of the selected remedy. If possible, cleared debris such as trees, shrubs, and stumps will be disposed of under the OU I cap. If there is not sufficient space under the cap for disposal of these materials, they will be disposed of off-Site. Although it is not expected that these materials will constitute RCRA hazardous waste, if it is determined that they do, they will be disposed of off-Site in accordance with RCRA requirements. After areas have been cleared, grading will be performed to provide a level surface for the operational areas.

Adverse impacts to wetlands and wildlife will be minimized during all Site preparation activities. To the extent practicable, consideration will be given to seasonal constraints to minimize impacts to wildlife during these activities.

2. Removal of Section of OU I Cap

A portion of the existing cap constructed under OU I will be removed (see Plate 1). This will be done by excavating the material above the liner in the area to be removed. This material will be stockpiled and to the extent practicable, used to rebuild the cap when remediation is complete. The liner will then be cut out. Next, the bentonite layer will be broken out, excavated or saw cut. The practicability of reusing cap materials will be determined during remedial design. If it is determined during design that this material will be re-used, it will be stockpiled until it is used in reconstruction.

3. Excavation of Clean Fill from under OUI Cap

Clean soils will be excavated from the area where the cap was removed. Survey information from construction of OU I indicates the vertical and lateral limits of this clean soil. A buffer of clean soil will be left between the contaminated materials under the cap and the limits of excavation. If suitable, the clean material excavated will be used to create a temporary water control berm around the exposed area. This excavated material will be tested to determine its suitability for use to backfill the wetland areas to be excavated. If it is found to be suitable, this clean fill will be used for the reconstruction of the wetlands; if it is not suitable, it will be disposed of in an appropriate off-Site location. Criteria to determine the suitable use of this material will be developed as part of the wetland restoration program during remedial design.

4. Excavation of Contaminated Sediment

Four areas, referred to as the Continuing Source Areas, shall be excavated. These areas include the Eastern Wetland, Trolley Brook, Outfall Creek and the lower Raceway (see Figure 3). The approximate surface areas of these areas are approximately 295,110 square feet. These areas shall be excavated by conventional mechanical means to a depth of up to approximately 4 feet in the Eastern Wetland and Trolley Brook and approximately 1 foot in Outfall Creek and the lower Raceway. This excavation will remove sediments with mercury in excess of the 1 mg/kg cleanup level. A total of approximately 20,206 cubic yards of contaminated sediments shall be excavated. These depths and volumes will be further refined through predesign sampling.

A combination of conventional mechanical means shall be used including the following: clamshell dredge, dragline dredge, backhoe, suction dredge, cutterhead dredge, dustpan dredge and portable hydraulic dredges.

To implement this component, a processing area will be set up prior to sediment excavation. The processing area will be constructed so as to prevent, to the extent possible, any migration of the excavated soils and

any adverse impacts to wetlands.

Characteristics between the four Continuing Source Areas to be excavated vary somewhat and different techniques for staging, dredging and transport may be appropriate. The most appropriate technique for conducting the excavation for each area will be determined during remedial design. Excavated sediments from the Outfall Creek and lower Raceway areas will need to be transported for a short distance on public roads to the Property. The volume of this material was estimated to be only 121 cubic yards of the estimated 20,206 cubic yards to be excavated under the selected remedy. As described in the Site Preparation component of the selected remedy above, measures will be implemented to limit potential air emissions from excavation activities. An air monitoring program shall be implemented during the performance of on-Site sediment excavation components of the remedy to determine risks to on-Site workers and nearby residents. Air sampling stations will be located at representative points throughout the remediation area and at the perimeter of the work zone.

This portion of the selected remedy shall be implemented in a manner that mitigates any contaminant migration downstream. The method of isolating contaminated sediments will be determined during design of the selected remedy, considering also the need to mitigate wetland impacts.

Confirmatory sampling will be conducted following excavation to determine that clean-up levels have been attained.

Because the areas to be excavated are wetlands, excavation and associated activities will be performed to minimize adverse impacts to wetland areas. EPA has determined that, for this OU, there are no practicable alternatives to the Site preparation and sediment excavation components of the selected remedy, that would achieve Site goals but would have less, short-term adverse impacts on the ecosystem. Therefore, measures will be performed to mitigate these impacts. Sedimentation basins and/or silt curtains will be installed downstream to capture any particles that may become suspended during excavation activities. During excavation and dewatering of mercury contaminated sediments, downstream monitoring of surface water will be conducted to ensure that transport of contaminants is not occurring as a result of the excavation. Excavated areas shall be isolated by means of erosion control devices (e.g. sandbags, haybales or earthen dikes) and sedimentation control devices (e.g. sedimentation basins), and diversion structures. To the extent practicable, consideration will be given to seasonal constraints to minimize impacts to wildlife during these activities.

In addition to these minimization components, steps will be taken to restore impacted wetland areas as described in component 7 of the selected remedy below.

5. Dewatering and Disposal

Because the excavated sediments will contain liquids when excavated, a dewatering process (e.g. filter presses) shall be used following excavation. Dewatering will reduce the moisture content of the excavated materials and facilitate their handling and transport. The dewatering system shall consist of mechanical (e.g. belt filter presses, recessed chamber filter presses, centrifuges) and/or chemical processes (e.g. flyash addition) and would be designed based on results of bench-scale and chemical tests. Following the dewatering process, sediments will be tested to determine that they pass the paint filter test prior to disposal under the cap. If they fail to pass this test, additional dewatering measures will be taken.

Water extracted from the excavated materials shall be adequately stored and treated as necessary to remove residual contaminants to protective levels. Treated effluent shall be discharged to an on-Site surface water body. Treatment residuals will be disposed of off-Site. If it is determined that treatment residuals constitute RCRA hazardous waste, they will be disposed of off-Site in accordance with RCRA requirements. Predesign studies will be conducted to determine the need to treat water from the dewatering process.

Following dewatering, the excavated materials would be transported to the OU I cap area and disposed of under the cap. The estimated capacity of the OU I cell to be used is 25,000 to 30,000 cubic yards. The current estimate of sediment to be excavated under the selected remedy is approximately 20,000 cubic yards. Therefore, EPA expects that the OU I cell will have sufficient capacity for disposal of all contaminated sediments from OU III. The areal extent and vertical profile of the existing Cap will not be increased under this remedy. In addition, if it is determined that previously undisturbed materials from the cell need to be excavated during Remedial Action, this material will be characterized during remedial design. Predesign sampling will be conducted in the Continuing Source Areas to further delineate mercury depth profiles, to refine the volume estimates of mercury-contaminated sediment requiring excavation, and to delineate initial vertical and lateral boundaries for sediment excavation. During remedial design a detailed evaluation will be made of existing cap capacity and the refined volume of material requiring disposal. The purpose of this evaluation will be to determine if, based on best engineering practices, there is sufficient storage capacity in the cell for OU III materials. If it is determined that the contaminated sediments to be excavated and disposed are likely to exceed cell capacity, or if this is found to be the case during construction, EPA will proceed in accordance with Section 300.435(c)(2) of the NCP.

Contaminated materials deposited in the OU I cell will be at least 4 feet above the probable high groundwater level in the area of the cell. During remediation, any rain water that may come in contact with excavated material deposited in the cell will be controlled through engineering and construction techniques.

Activities relating to the disposal and transportation of these sediments will be performed so as to minimize potential destruction or loss of wetlands or adverse impacts to organisms.

6. Rebuild the Removed Portion of OU I Cap

The cap, as designed for OU I, will be reconstructed in the area where it was removed. To the extent possible, materials removed during the cap removal will be used to rebuild the cap. The reconstructed cap shall meet the performance standards required under OU I including the following: (1) it shall have a permeability less than or equal to 1×10^{-7} cm/sec; (2) it shall function with minimum maintenance; (3) it shall promote drainage and minimize erosion or abrasion of the cover; and (4) it shall accommodate settling and subsidence so that the cover's integrity is maintained. Both lab and field tests (including undisturbed core sampling) shall be performed to check compliance with the permeability requirement. During the design analysis it will be determined if it is feasible to re-batch the existing bentonite. If this is not possible, a new mixed batch of bentonite will be used. As stated in component 2, to the extent practicable, the material over the existing liner will be stockpiled and used for reconstruction of the cap. In replacing the liner, the liner rolls will be overlapped and the seams will be heat welded in accordance with current construction methods used under OU I.

7. Wetlands Restoration

EPA has determined that, for this Site, there are no practicable alternatives to the selected remedy that would achieve Site goals with less, short-term adverse impacts on the ecosystem. Unless sediments with contaminant levels greater than the target levels are excavated, the contaminants in the sediments would continue to pose an unacceptable ecological risk. Thus, excavation of the contaminated sediments is necessary.

This excavation of contaminated sediments and ancillary activities will result in unavoidable temporary impacts and disturbance to wetland resource areas. Such impacts may include the destruction of vegetation and the loss of certain plants and aquatic organisms. Impacts to the fauna and flora will be mitigated in accordance with the minimization methods discussed under component 4, above, and the restoration/enhancement requirements discussed below. Wetland enhancement will only be performed if it is determined that a portion of the existing wetland cannot be restored.

This wetland restoration/enhancement program will be implemented upon completion of the remedial activities in wetland areas adversely impacted by remedial action and ancillary activities. All excavated areas will be backfilled with suitable material, graded, stabilized and planted. The area will be restored to appropriate elevation contours and similar vegetation will be planted. Organic fill material will be distributed throughout the excavated areas to create grading, elevation and drainage approaching original patterns and to serve as substrate for replacement of vegetation.

The restoration program will be developed during design of the selected remedy to replace wetland functions and habitat areas. Pre-remediation conditions in wetlands likely to be impacted by remedial activities shall be assessed prior to disturbance. This pre-remediation assessment shall be the baseline by which compliance with wetland restoration performance standards shall be measured. This baseline assessment shall characterize the existing wetlands with regard to hydrology, soil characteristics, depth of organic soils, vegetation, diversity, and other appropriate criteria and shall include a thorough analysis of the existing and potential values and functions of the wetland. This assessment shall also include a field investigation to determine the presence of and map the occurrence of any Federal Endangered or Threatened Species and Massachusetts Rare Species within areas likely to be impacted by remedial activities. Based on the pre-remediation assessment, the wetlands restoration plan will identify the factors which are key to a successful restoration and/or enhancement of the altered wetlands. Factors will include, but not necessarily be limited to, replacing and regrading hydric soils, provisions for hydraulic control and provisions for vegetative reestablishment, including transplanting, seeding, or some combination thereof. For restored areas, wetland plant species shall be of sufficient diversity to provide habitat for a variety of indigenous animal species equivalent to conditions existing prior to remedial activities. Habitat value will be evaluated using three endemic species (2 plant/1 animal) to monitor for successful restoration. Quality assurance measures shall include; (1) detailed topographic and vegetative surveys to ensure replication of proper surface elevations and vegetation; (2) engagement of a wetland replication specialist; (3) establishment of work area limits for equipment to prevent inadvertent placement of fill; (4) production of a reproducible base map and a detailed planting scheme; (5) photographic documentation; and (6) description of pre-remediation conditions.

EPA, in consultation with DEP, shall determine when specific restoration activities shall be performed. Consideration shall be given to breeding

seasons, climatic conditions, and the time frame between excavation activities and restoration activities. The restoration program will include monitoring requirements to determine the success of the restoration. Periodic maintenance (e.g. planting) may also be necessary to ensure final restoration of the designated wetland areas.

8. Long-Term Environmental Monitoring

At the completion of remedial action, no contamination above background levels will remain in the Continuing Source Areas. Therefore, a five year review will not be necessary in these areas.

Long-term monitoring of these areas, however, shall be conducted to ensure the long-term effectiveness of the wetland restoration program.

As required by law, EPA will review the remedy, including the cap, at least once every five years after initiation of remedial action to assure that the remedial action continues to be protective of human health and the environment. This review will be conducted under the OU I remedy.

9. Institutional Controls/Additional Studies

A fourth OU to further investigate contamination in the Sudbury River will be implemented to select a final remediation plan for the River. Until such time as this final remedy is selected, institutional controls (e.g. sign maintenance and public awareness activities) shall be implemented along the Sudbury River as an interim remedy to deter consumption of fish by fishermen along the River. Warning signs alerting anglers to the risks from ingestion of contaminated fish will be maintained along the River until a final remedy is implemented for these areas.

EPA will also implement a public awareness campaign in conjunction with DEP and the towns along the River until a final remedy decision is made under OU IV. The purpose of the public awareness campaign is to increase the awareness of the public about the risks from consumption of contaminated fish. EPA, in coordination with DEP, will work with officials from affected towns, representatives from existing River groups (e.g. Framingham Advocates for the Sudbury River, Sudbury Valley Trustees, Wild and Scenic Rivers Study Committee) and other interested community groups to evaluate and implement public awareness activities. These activities may include identification of groups likely to be eating contaminated fish, identification of methods to educate the impacted groups on an ongoing basis, identification of measures to evaluate the effectiveness of the public awareness program and establishing a timeframe for implementing the plan.

In addition, institutional controls will be implemented in the vicinity of the cap to prevent activities that would compromise the integrity of the cap.

10. Restoration of Trolley Brook Wetland (Area G)

Following remediation of the Eastern Wetland the culvert between the Eastern Wetland and Trolley Brook Wetland (Area G) will be reopened and Area G will be restored. As explained in the September 21, 1992 Explanation of Significant Differences, this culvert was not reopened at the completion of OU I activities because of the risk of recontaminating Area G.

Restoration of Area G will be completed based on a wetland restoration plan to be developed during design. This plan will include planting and other activities to restore the wetland to its preconstruction state and will be based on historical information (e.g. aerial photography) regarding the wetland.

XI. STATUTORY DETERMINATIONS

The remedial action selected for OU III is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, attains ARARs and is cost effective. The selected remedy does not, however, satisfy the statutory preference for treatment which permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element, based on the reasons discussed in Section XI.E. below. Additionally, the selected remedy utilizes alternate treatment technologies or resource recovery technologies to the maximum extent practicable.

A. The Selected Remedy is Protective of Human Health and the Environment

The selected remedy will permanently reduce the risks posed to human health and the environment from the Continuing Source Areas by eliminating, reducing or controlling exposures to human and environmental receptors through containment and engineering controls. Excavation of sediments with mercury exceeding the cleanup goal, as required by the selected remedy, will permanently and significantly reduce the risks to human health and the environment associated with exposure to contaminated sediments in the Continuing Source Areas. In addition, the selected remedy will temporarily control risks to human health from River Areas through institutional controls.

As discussed above in Section IX, the selected remedy will be protective of ecological receptors within the Continuing Source Areas. This cleanup level reduces mercury levels approximately to concentrations of mercury found at locations upgradient of the Site. The selected clean-up level is also below the median biological effects level (ER-M) reported by NOAA in "The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program" (NOS OMA 52). This ER-M, the contaminant level above which adverse effects to ecological receptors are expected, is 1.3 ppm for mercury in sediment.

In addition, as discussed in Section IX, the cleanup goal of 1 ppm is protective of human health for all accidental ingestion and dermal contact exposure scenarios. This cleanup level is expected to result in a hazard index of less than one for these scenarios in the Continuing Source Areas. Moreover, by reducing migration of contaminated sediments to the Sudbury River, the selected remedy is expected to prevent risks in the River Areas from increasing.

Under the selected remedy, disposal of excavated materials under the impermeable cap will provide a barrier against exposure to contaminated sediments to both human and ecological receptors. Periodic Site visits and maintenance will be performed to ensure the integrity of the cap, and its effectiveness in preventing exposure to contaminated sediments. In addition, institutional controls will be implemented to prevent activities that will compromise the integrity of the cap.

Finally, implementation of the selected remedy will not pose unacceptable short-term risks or cross-media impacts. Most of the Site work will be conducted in non-residential areas. Implementation of this remedy may result in a slight increase in exposure to mercury and other contaminants for workers during remedial activities. However, any short-term risks will be mitigated by requiring workers to wear protective clothing. In addition, the breathing zone will be monitored and protection provided if necessary. Dust is not expected to be a problem during excavation or transport of sediment; however, control measures such as water sprays will be kept

available in cases roadways or other areas become too dry. For all remedial activities that include sediment movement, an air monitoring program will be implemented during the performance of the activities to determine risks to on-Site workers. Measures will be utilized to limit potential air emissions from Site preparation, excavation and disposal activities including the following methods: enclosure of work areas; emission suppression techniques (e.g. foam, water spray); and containment of excavated sediments.

Short-term risks would also be present for wildlife in and around the wetlands during the limited time that Site remediation and restoration would be required. However, engineering controls would be chosen and implemented to minimize downstream impacts resulting from excavation and other impacts on the wetlands, including the use of sandbags, earthen dikes, silt curtains and sedimentation basins.

The mitigative measures, described above, would also serve to prevent unacceptable cross-media impacts during implementation of the selected remedy. In addition, containment of the sediments, as required by the selected remedy, would not result in cross-media impacts because disposal under an impermeable cap would prevent the transport of contaminants from sediments to air and surface waters.

B. The Selected Remedy Attains ARARs

This remedy will attain all applicable or relevant and appropriate federal and state requirements. Federal environmental laws from which ARARs for the selected remedial action are derived include, but are not limited to:

- Clean Water Act (CWA)
- Executive Order 11988 (Floodplain Management)
- Executive Order 11990 (Protection of Wetlands)
- Fish and Wildlife Coordination Act
- Clean Air Act (CAA)
- National Historical Preservation Act
- Protection of Archaeological Resources
- Endangered Species Act
- Wild and Scenic Rivers Act
- Federal Noise Control Act

State environmental laws and regulations from which ARARs for the selected remedial action are derived include, but are not limited to:

- Hazardous Waste Regulations
- Surface Water Quality Standards
- Air Pollution Control Regulations
- State Implementation Plans for Particulate Matter and Volatile Organic Compounds
- Wetlands Protection Act
- Endangered and Threatened Species Regulations

Tables 7, 8, and 9 provide a synopsis of all ARARs and to be considered requirements for the selected remedy. A brief narrative summary of the major ARARs follows:

A. Sediments

Hazardous Waste Management Requirements under RCRA

EPA has determined that the hazardous waste management regulations, set forth in Subtitle C of RCRA, including land disposal restrictions (set forth in 40 CFR Part 268), are not applicable to the selected remedy. In order for RCRA requirements to be applicable to a CERCLA remedy, there must be a

finding that (i) the remedy involves a waste which is a listed or characteristic waste under RCRA; and (ii) the waste was treated, stored, or disposed after the effective date of the RCRA requirements at issue or the remedy will involve treatment, storage or disposal as defined under 40 CFR 260.10.

The sediments in the Continuing Source Areas are not listed wastes under RCRA but may be characteristic wastes. Samples of sediments in the Continuing Source Areas were analyzed using the Toxicity Characteristic Leaching Procedures during OU III investigations. Several contaminants exceeded maximum concentration for the Toxicity Characteristic. However, these wastes were not disposed of in the Continuing Source Areas after the 1980 effective date of RCRA. In addition, under the selected remedy, excavated sediments will not be treated or stored before burial in a cell of the impermeable cap constructed under OU I. Furthermore, EPA has determined that excavation and burial under the OU I cap constitutes consolidation of contaminants within a single area of contamination and therefore is not land disposal under RCRA. Because the selected remedy will not involve treatment, storage or disposal as defined by 40 CFR 260.10, the corresponding RCRA requirements are not applicable to the selected remedy.

EPA has similarly determined that RCRA generator requirements are not applicable. A hazardous waste generator, under 40 CFR 260.10, is one, by site, who produces a hazardous waste or first causes the waste to be regulated as hazardous. The excavation of contaminated sediments from the Continuing Source Areas will not "produce" a hazardous waste nor will it subject the waste to hazardous waste regulation since, as discussed above, the selected remedy will not involve treatment, storage or disposal as defined by RCRA.

However, because certain RCRA regulations address activities sufficiently similar to those contemplated by the selected remedy, EPA has determined that those RCRA requirements are relevant and appropriate. The Commonwealth of Massachusetts has been authorized by EPA to administer and enforce RCRA programs in lieu of the federal authority. Compliance with Massachusetts Hazardous Waste Regulations is discussed below.

Massachusetts Hazardous Waste Regulations

Based on the discussion of Federal RCRA requirements above, EPA has determined that Massachusetts Hazardous Waste Regulations are not applicable to the selected remedy. However, because the regulations address activities sufficiently similar to those contemplated by the selected remedy, EPA has designated certain provisions of the regulations as relevant and appropriate and will comply with the substantive requirements during implementation of the selected remedy. These requirements include, among others, requirements for generators and transporters of hazardous wastes and management and technical standards for hazardous waste facilities and landfills. These requirements are set forth in various sections of 30 CMR 30.000 et seq and are listed in Table 9.

B. Floodplains and Wetlands

The regulations under Section 404 of the Clean Water Act (CWA) are applicable to the selected remedy, because construction of access roads will involve discharge of dredged or fill material into a water of the United States. In addition, wetlands restoration will involve backfilling to the extent necessary to create grading, elevation and drainage approaching original patterns and to serve as substrate for replacement of vegetation.

Regulations promulgated under the CWA require that, before a project which

involves a discharge of dredge or fill material into a wetland is undertaken, there must be an analysis of the impact of such a project on the aquatic environment, and a comparison to other practicable alternatives (40 CFR Section 230.10(a)). In this case, EPA compared the selected remedy to other alternatives which did not involve discharge of fill material to wetland areas. EPA compared excavation (as called for in the selected remedy) to: (1) a "no-action" remedy; (2) a "limited action" remedy (no action with institutional controls); (3) capping contaminated sediments in the Eastern Wetland; and (4) diverting surface water from the Eastern Wetland to a constructed sedimentation basin.

EPA determined that none of the alternatives to excavation would be able to achieve the overall purpose of the project, which is to attain clean-up levels protective of human and environmental receptors in the Continuing Source Areas, without causing other significant adverse impacts to the environment. Specifically, the "no-action" and "limited action" remedies would leave mercury in place and human and environmental receptors would be at risk due to exposure to this contaminant. Thus, although the habitat would remain intact, adverse environmental effects due to the presence of mercury would continue. Capping of the contaminated sediments in the Eastern Wetland was found to be ineffective due to the probability that a cap in a wetland area would erode and the contaminants would be re-exposed. In addition, capping in place would result in permanent loss of wetland habitat and loss of flood storage capacity, thereby having an even greater adverse impact to wetlands and floodplains than the selected remedy. Finally, diversion of surface water from the Eastern Wetland to a constructed sedimentation basin, although it would reduce somewhat the migration of mercury to the Sudbury River, would only minimally reduce risk to human health and the environment because exposure to the contaminated sediments and surface water above protective levels would continue to occur. In addition, because of Site restrictions, the only available location to construct a sedimentation basin is in a wetland area. Therefore, this alternative would result in long-term loss of wetland habitat, thereby having an even greater adverse impact to wetlands than the selected remedy.

Based on the foregoing analysis, EPA has concluded that excavation of sediments contaminated with mercury above the 1 mg/kg cleanup level followed by wetland restoration is the only alternative that will be protective of human and environmental receptors while minimizing adverse effects on wetlands habitat. Accordingly, EPA has determined that there are no other practicable alternatives which would have less adverse impact on the aquatic ecosystem than the impacts of the selected remedy.

The selected remedy also satisfies the substantive requirements of 40 CFR 230.10(b). Mitigation techniques such as silt curtains will be used so that the action will not cause or contribute to the violation of a state water quality standard; the action will not violate toxic effluent standards under the Clean Water Act; and the action will not jeopardize the continued existence or critical habitat of species listed in the Endangered Species Act. In addition, consistent with 40 CFR Section 230.10(c), the selected remedy will not cause or contribute to significant degradation of the waters of the United States. Specifically, any discharges of wastewater will be monitored and treated, if necessary, to ensure that they will not have a significant, longterm adverse effect on (i) human health or welfare, (ii) aquatic life and other wildlife, (iii) ecosystem diversity, productivity and stability and (iv) recreational, aesthetic and economic values. Finally, the selected remedy will minimize adverse impacts to the aquatic ecosystem in accordance with 40 CFR Section 230.10(d), by creating sedimentation basins and by restoring the wetlands, to the extent feasible.

In addition, the policies expressed in Executive Orders regarding wetlands

and floodplains were taken into account in the selected remedy. As described above, the remedy will include steps to minimize the destruction, loss, or degradation of wetlands in accordance with Executive Order 11990. In addition, the remedy will include steps to reduce the risk of floodplain loss, including the distribution of fill material in the Eastern Wetland to create grading, elevation and drainage consistent with original patterns, in accordance with Executive Order 11988.

Finally, the substantive requirements of Massachusetts Wetlands Protection Regulations concerning dredging, filling, altering or polluting inland wetlands are applicable to the dredging of the Continuing Source Areas. These standards set performance standards for banks, vegetated wetlands, lands under water, and land subject to flooding. During remedial design, EPA will determine which of these resource areas will be impacted during remedial action. The selected remedy will comply with the performance standards for each such resource area and will among other things, involve a one-for-one replication of any hydraulic capacity which is lost as the result of this part of the remedial actions.

It is anticipated that the selected remedy will require a variance from selected requirements contained in the Massachusetts Wetland Protection Regulations because, at a minimum, it will result in the temporary loss of more than 5000 square feet of bordering vegetated wetlands. The selected remedy satisfies the substantive requirements for a variance (310 CMR 10.58). As a condition for satisfying the substantive requirements for this variance, three sensitive endemic species shall be used to monitor for successful restoration.

Because the Continuing Source Areas are within the areal extent of contamination, they are considered part of the Site, and EPA is not required to obtain permits for wetland activities.

C. Surface Water

Certain regulations under the CWA are applicable to the discharge of treated waters to any of the surface waters on-Site. In implementing the selected remedy, any wastewater discharges will be monitored and will comply with water quality standards in accordance with the National Pollution Discharge Elimination System (NPDES), 40 CFR 122, 125. However, under Section 121(e) of CERCLA, no permit is required under the NPDES program for these discharges, because the effluent from the treatment facilities (e.g. dewatering) will be discharged directly into a surface water of the United States at a point considered part of the CERCLA Site.

AWQC are developed under the CWA as guidelines from which States develop water quality standards. Massachusetts Surface Water Quality Standards have been developed using the federal criteria and are applicable to discharges to all surface water bodies. These State standards categorize surface waters of the Commonwealth according to their uses and set water quality criteria necessary to sustain such designated uses. The Sudbury River has been designated a Class B river for protection and propagation of fish, other aquatic life and wildlife, as well as for other recreational purposes. In implementing the selected remedy, discharge limits will be calculated by using these water quality standards. In addition, whole effluent toxicity limits will be used to set discharge limits which are protective for cumulative effects from multiple contaminants and for those contaminants for which there are no criteria. Because the effluent from dewatering activities will be discharged to an on-Site surface water body, no permit is required.

Moreover, the water quality standards for mercury are currently exceeded in the Eastern Wetland and Outfall Creek. Implementation of the selected

remedy, which calls for the excavation of sediments exceeding 1 mg/kg mercury, is expected to result in a decrease in surface water mercury levels below the levels established under the water quality standards as necessary to sustain a Class B river.

D. Air

National Ambient Air Quality Standards for particulate matter and volatile organic compounds under the Clean Air Act are ARARs and will be attained during construction phases. The Massachusetts State Implementation Plans (SIPs) contain the specific requirements designed to ensure that these standards are met.

The SIP for Particulate Matter requires that any construction shall not be allowed to cause "excessive emissions" of particulate matter and specifies measures which can be taken to control such emissions. Dispersal of dust will be controlled under the selected remedy by spraying of roads and excavated sediments and soils. In addition, at the completion of Site remediation, disturbed areas will be revegetated.

The SIP for Emissions of Volatile Organic Compounds (VOCs) is relevant and appropriate to the selected remedy since some VOCs have been detected in the sediments to be excavated. The SIP requires that all sources emitting 100 tons or more of VOCs must install Reasonably Available Control Technology. VOCs contribute to ozone production. Because the Site is located in an ozone non-attainment area, the Region has determined that it is appropriate to control VOC emissions, even if they do not exceed the threshold amount set forth in the SIP, in accordance with Regional policy. Therefore, air emissions will be monitored and, if necessary, measures will be taken to control emissions in accordance with Reasonably Available Control Technology.

E. Other Laws

The selected remedy will comply with certain other laws and regulations, although strictly speaking, they are not ARARs because they are not environmental laws or relate to off-Site activities. These laws include, but are not limited to: the Occupational Health and Safety Act, 29 USC 651 et seq.; Department of Transportation Hazardous Material Transportation Act regulations, 49 CFR 171-179, 387; Massachusetts Requirements for Transporters of Hazardous Waste, 30 CMR 30.400; and Massachusetts Right to Know Requirements, 105 CMR 670.00, 310 CMR 33.00, and 454 CMR 21.00.

C. The Selected Remedial Action is Cost-Effective

The selected remedy is effective. It provides for excavation of mercury-contaminated sediments exceeding 1 mg/kg in the Continuing Source Areas, a level that is protective of both human and ecological receptors in these areas. The excavated sediments will be disposed of under the impermeable cap constructed under OU I. Periodic Site visits and maintenance will be performed to ensure the integrity of the cap and its effectiveness in preventing exposure to contaminated sediments. As discussed in Section IX.C.1, above, the long-term effectiveness and permanence afforded by the selected remedy is equivalent to that afforded by the other 'A' alternatives.

In comparison to the other 'A' alternatives, the selected remedy is the least costly, with a present worth cost of \$20,419,000. In contrast, present worth costs of other action alternatives range from \$24,593,000 to \$47,799,000. As stated in Section IX.C.5, it should be noted that the Operation and Maintenance costs for these alternatives assume 30 years of

Operation and Maintenance estimated at approximately 6.8 to 7.3 million dollars (net present worth). These Operation and Maintenance costs include activities such as annual monitoring and institutional controls for the Sudbury River. However, because investigation under OU IV will be performed concurrently with the implementation of the OU III remedy, monitoring of the River will be conducted as part of these OU IV investigations. In addition, institutional controls are an interim remedy only, pending the OU IV remedy decision. Therefore, the cost of the selected remedy will be significantly less than \$20,419,000. Based on the discussion above, the selected remedy is cost-effective.

D. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy provides the best balance of trade-offs among the alternatives. The selected remedy will be protective of human health and the environment in the Continuing Source Areas by reducing contaminant levels to meet cleanup levels and will meet ARARs. Excavation, dewatering and disposal of sediments under the existing cap will provide effective long-term protection in the Continuing Source Areas without unacceptable short-term impacts and at less cost than Alternatives 3A and 4A. Furthermore, of all the 'A' alternatives, the selected remedy will be the most easily implemented as it would not require use of specialized units and would not require additional land or availability of substantial off-Site disposal capacity.

The placement of excavated sediment under the cap will not decrease the mobility, toxicity or volume of contaminated materials through treatment, but will nevertheless significantly reduce the mobility of hazardous substances through engineering controls by containing the contamination under an impermeable cap. Although Alternative 3A would permanently reduce the volume of contaminated sediments through treatment, this treatment would result in a smaller volume of more highly toxic material requiring off-Site transport and disposal due to the inability to destroy metals through treatment. Similarly, Alternative 4A, while reducing mobility and toxicity of the contaminated sediments, would result in greater volume of material requiring off-Site transport and disposal. Therefore, the treatment alternatives do not provide any significant benefit over the containment remedy.

E. The Selected Remedy is Primarily a Containment Remedy, and Does Not Use Treatment as a Principal Element to Permanently and Significantly Reduce the Toxicity, Mobility or Volume of the Hazardous Substances

The principal threats of the Nyanza Site were addressed through the first and second OUs, which included source control components for on-Site soils, sediments and sludges and management of migration components for groundwater contamination, and through the vault removal action, in which a major source of groundwater contamination was excavated and permanently destroyed using incineration technology. Implementation of the OU III remedy is necessary to address threats to human and ecological receptors at the Continuing Source Areas, to eliminate remaining sources of mercury contamination to the Sudbury River and to ensure a Site-wide remedy that is protective of human health and the environment.

The selected remedy is primarily a containment remedy and does not satisfy the preference for treatment as a principal element. However, given the relatively low levels of mercury detected in the Continuing Source Areas as compared to levels already beneath the cap, the fact that a cap was selected as the appropriate remedy for mercury-contaminated soils, sediments and

sludges under the first OU, and the fact that there is currently no destructive technology for metals, EPA has determined that containment of the contaminated sediments in the Continuing Source Areas is preferable to treatment. Moreover, the overall response at the Site is consistent with the NCP preference for treating principal threats and containing low-threat material set forth in Section 300.430(a)(1)(iii) of the NCP.

XII. DOCUMENTATION OF SIGNIFICANT CHANGES

EPA presented a Proposed Plan (preferred alternative) for remediation of the Site on December 31, 1992. In summary, the preferred alternative, as described in the Proposed Plan, consisted of excavation of contaminated sediments from the Continuing Source Areas to a cleanup level of 1 mg/kg of mercury; dewatering of the excavated sediment; disposal of the excavated material under the OU I cap; restoration of impacted wetland areas; institutional controls and annual monitoring for River areas; and creation of OU IV to conduct additional studies of the Sudbury River.

The selected remedy is the same as the preferred alternative with the exception of the annual monitoring of the Sudbury River. EPA determined that monitoring of the River would be conducted under the OU IV investigations concurrently with implementation of the OU III remedy. Therefore, it is not a part of the selected remedy for OU III. In addition, EPA determined that the implementation of institutional controls (e.g. sign maintenance and public awareness activities) do not constitute Operation and Maintenance for this remedy but, rather, are an interim remedy for the River that will be conducted until such time as a final remedy is selected for the River.

XIII. STATE ROLE

The DEP has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the Remedial Investigation, Risk Assessment and Feasibility Study to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental laws and regulations. The Commonwealth of Massachusetts concurs with the selected remedy for OU III at the Nyanza Chemical Waste Dump Superfund Site. A copy of the declaration of concurrence is attached as Appendix B.

APPENDIX B

CONCURRENCE LETTER FROM THE

COMMONWEALTH OF MASSACHUSETTS

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection

William F. Weld
Governor
Daniel S. Greenbaum
Commissioner

March 29, 1993

Mr. Paul Keough
Acting Regional Administrator
U.S. Environmental Protection Agency
Region 1

JFK Federal Building
Boston, MA 02203-2211

RE: Nyanza Chemical Waste Dump
Federal Superfund Site --
Operable Unit Three
ROD CONCURRENCE

Dear Mr. Keough:

The Department of Environmental Protection (the "Department") has reviewed the preferred remedial alternative selected by the Environmental Protection Agency ("EPA") for the Operable Unit Three Nyanza Chemical Waste Dump Federal Superfund Site cleanup. Based upon its review, the Department concurs with EPA's choice of this alternative as the selected remedial action.

The preferred alternative provides a source control remedy for the Continuing Source Areas and institutional controls and a public awareness program for the Sudbury River Area. Key components of the preferred alternative include:

1. performance of certain pre-design studies including refined delineation of locations in the Continuing Source Areas exceeding the target sediment/soil cleanup goal;
2. excavation and dewatering of contaminated sediments and soils from portions of the Continuing Source Areas;
3. excavation of imported fill from beneath a portion of the cap that was previously constructed as part of the Operable Unit One remedy;
4. disposal of dewatered, contaminated sediments/soils beneath the opened portion of the Operable Unit One cap and rebuilding of the cap;
5. treatment, if necessary, of water from the dewatering operation with discharge to an on-site surface water body;
6. restoration of all impacted wetlands;
7. implementation of a public awareness program regarding Sudbury River Area contamination;
8. institutional controls to limit exposure to contaminants in the Sudbury River Area; and
9. creation of a Fourth Operable Unit to develop a final cleanup plan for the Sudbury River Area.

The selected remedy contains several modifications from the preferred alternative presented in EPA's Proposed Plan. These modifications, in part, address concerns raised during the public comment period, and include the following:

1. a requirement that the areal extent and vertical profile of the existing cap will not be increased as a result of the disposal of the contaminated material;
2. performance of predesign sampling to refine volume estimates of the contaminated material to be excavated;

3. during remedial design, a detailed evaluation of existing cap storage capacity and the refined volume of contaminated sediments/soils requiring disposal, using the information obtained pursuant to the above paragraph; the purpose of this evaluation will be to determine, based upon best engineering practices, whether there is sufficient storage capacity in the cap for that material within the dimensional parameters set forth above; and

4. if it is determined pursuant to this evaluation that the cap's storage capacity is insufficient for disposal of this material, then the selected remedy will be re-examined through an "explanation of significant differences" or an amendment to the record of decision, as necessary, pursuant to therelevant provisions of CERCLA, SARA and/or the NCP.

Notwithstanding the foregoing modifications, the Department notes that the preferred remedial alternative does not fully accommodate certain public concerns raised during the public comment period. Therefore, the Department strongly recommends that EPA, as the lead agency for this site, establish an ongoing dialogue with citizens and local officials to address public concerns throughout the remediation process. The Department is willing and eager to assist EPA in developing and implementing a public involvement process for this purpose.

The Department has evaluated the preferred alternative for consistency with M.G.L. c. 21E and the Massachusetts Contingency Plan (the "MCP"), as well as with proposed revisions to the MCP currently under consideration. Based upon this review, the Department has determined that the preferred alternative would constitute a temporary solution consistent with the requirements of the MCP, as part of the phased implementation of a temporary and permanent solution. The Department notes, however, that a permanent solution determination cannot be made until it has been demonstrated that the remedial measure or combination of measures will meet both the total site cancer and non-cancer risk limits as set forth in the MCP for the entire site.

The selected remedy appears to meet all applicable or relevant and appropriate requirements ("ARARs") of the Commonwealth, based on information presently available. The Department will continue to evaluate whether the preferred alternative will satisfy the Commonwealth's ARARs as remedial design progresses and during implementation and operation.

The Department looks forward to continuing to work with you in implementing the selected remedial actions. If you have any questions, please contact Charla Reinganum of my staff at 292-5826. Very truly yours,

Daniel S. Greenbaum
Commissioner

DSG/BWSC/cbr
cc: Dick Chaplin, NERO
Andrew Cohen, OGC
Ashland Board of Selectmen
State Senator David Magnani
State Representative John Stephanini
Ed Morrier, Framingham Advocates for the Sudbury River